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ABSTRACT

The basic purposes of the Profile Examination for Physician Extenders (PEPE) project included: (1) development of a computerized test item bank from which Profile Examinations could be generated, (2) review and analysis of curricula for the allied health groups, and (3) assessment of the reliability and validity of the Profile Examinations. The product of the PEPE project is a system, not a single examination. A library of over 10,000 multiple choice test items has been developed, from which tests can be generated with computer assistance. Such examinations have been generated and field tested at Sheppard Air Force Base, and at Ferris State College, Grand Rapids, Michigan. This complete system aids in the analysis of curricular content, the generation of related examinations, and the design of individualized curricula for allied health personnel who wish to extend their role at the physician assistant level. A description of the computer programs, bibliographical references, and guidelines for writing items are appended. The content of several curricula are illustrated and classified according to Medical Subject Headings (MeSH) codes: physician assistant, dietetics, medical technology, occupational therapy, physical therapy, radiologic technology, and respiratory therapy. (Author/BW)

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A PROFILE EXAMINATION SYSTEM FOR PHYSICIAN EXTENDERS AND A METHOD FOR CURRICULAR PRESCRIPTION

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FINAL REPORT

A PROFILE EXAMINATION SYSTEM FOR PHYSICIAN EXTENDERS AND A METHOD FOR CURRICULAR PRESCRIPTION

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October 1, 1977

The work on which this report is based was done under Contract N01-AH-44108 with the Division of Associated Health Professions, Bureau of Health Manpower, Health Resources Administration, Public Health Service, U.S. Department of Health, Education, and Welfare.

Final Report - A Profile Examination System for Physician Extenders and a Method for Curricular Prescription

Contract N01-AH-44108

October 1, 1977

FOR: Department of Health, Education, and Welfare
Public Health Service
Health Resources Administration
Bureau of Health Manpower
Division of Associated Health Professions

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Foreward

Effective utilization of all health manpower has been an increasingly expressed need as access and availability of health care receive appropriate emphasis. Assessment for informational competence, becomes a fundamental necessity as curricula become more varied and as health care roles are extended.

This project addressed itself to a basic need for the development of improved methods for internal evaluation in the health care field. As curricula are varied and health care professionals involve themselves in educational processes to extend their roles, periodic determination of informational strengths and weaknesses become increasingly important.

Emphasis should be placed on the fact that the profile examination is a system and not a single examination. The system is flexible and can provide a mechanism by which curricula can be assessed and compared for allied health care professionals, who may want to extend their roles. Fundamental to this concept, however, relates to the philosophical assumption which includes the fact that medical knowledge should be the same for any health professional, as individual tasks are performed at defined levels of responsibility.

Throughout the course of the Project, a substantial computerized test item library was developed (over 10,000 multiple-choice test items) from which profile examinations can be generated. The instrument has been found to be reliable and can be useful in assessing the knowledge necessary for the performance of a physician extender. The system enables one to conduct curricular content analyses, generate related examinations and make individual curricular prescriptions for allied health personnel who may want to extend their role at the physician assistant level.

While information and analyses in this project related primarily to undergraduate medical and allied health education, principles of the system can be readily transposed to continuing education at the graduate level.

This profile examination system should not be viewed as a static instrument. Continuous review by appropriate faculty and personnel will always be indicated. The instrument does provide a substantial nucleus by which improved methods for internal evaluation can be obtained.

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Lastly, Project personnel, additional contributors and consultants were all of great help as each performed their individual tasks in a highly professional manner.

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Chapter 1

PURPOSE AND METHODOLOGY

The purpose of this contract (Profile Examination for Physician Extenders) was to develop a system, not a single examination. This system included the development of a substantial computerized test item library consisting of multiple-choice test items relating to medical education. The item library ultimately enables an educational process to conduct a curriculum content analysis, generate examinations to test curriculum content, and make individual curricular prescriptions for Physician Extender Programs. Additionally, the system can be used for internal evaluation of individual performance, as well as assessment of curricular effectiveness and self-instruction.

Basic to the understanding of the content of this report are several factors, including a definition of terms which are subsequently used. The project's purpose revolved around development of an ultimate body of information (computerized test item library) relating to medical education of medical students, physician assistants, and other allied health professionals. This base instrument was used to generate Profile Examinations for medical students (who were at all levels of undergraduate experience at the University of Missouri-Kansas City School of Medicine), physician assistants, and other allied health professionals. Profile Examinations are defined as psychometrically sound test instruments, which provide balanced probes for information relating to curricular content. The term, Physician Extender, relates to a non-physician primary care practitioner who may be at the Physician Assistant level. In addition, extenders may be allied health professionals who desire to extend their role in the primary delivery of health care through additional education. In order for individual curricular prescriptions to be ultimately made for the allied health professions, stepwise comparisons were necessary to the development of the system. Informational and curricular content for medical education was compared with Physician Assistants and compared to other allied health professions. Emphasis should be placed on the fact that comparisons in this Project, were not intended to reflect high or low standards for any health professional group. Comparisons were necessary to document reliability of the system and to measure information by sound psychometric principles.

The need for non-physician primary care practitioners (Physician Extenders) is based on well documented facts and other assumptions, which show that a substantial portion of health care services can be delivered by Physician Extenders as members of the health care team. Other allied health personnel, such as physical therapists, respiratory therapists, dietitions, medical technologists, etc., also have substantial knowledge and responsibly participate in health care delivery. Many of these people, with additional specific education and training, could serve effectively as Physician Extenders.

Basic philosophical assumptions also include the fact that medical knowledge should be the same for any health professional, as individual tasks are discharged at defined levels of responsibility. This project addressed the problem of developing a Profile Examination System which could be the vehicle for assessing the knowledge necessary for performance as a Physician Extender. The mechanism for prescribing educational needs to fill gaps of information is the essential counterpart to the Profile Examination System. Such a dual system or mechanism should prove maximally efficient, can be objectively evaluated, and provide reliable data.

By design, the test item library and profile examination system were developed to accommodate an ultimate body of multiple-choice test items relating to medical education. In this contract, major concentration was concerned with those facts and informational items felt to be essential for people involved in the Physician Extender role. Further specification of the scope of work limited the focus of the project to the physician assistant. Field testing to ascertain the information which these health professionals had acquired, was also an integral part of the contract in determining validity and reliability of test results. While certifying examinations are available for many of the allied health professions and Physician Assistants, no instrument or system has been readily available for testing medical information for health professionals involved in varied curricular settings as an internal method of evaluation.

The system developed by this contract is consistent with previous recommendations made by the National Board of Medical Examiners (1973) in their goals and priority report. These recommendations included the fact that there was a need for educational institutions and/or processes to develop more substantive methods of internal evaluation, as the curricular process for medical education became increasingly varied.

In order to provide a framework for the generation of profile examinations which could be used to indicate individual strengths and weaknesses, and recommend curricular prescriptions, it was necessary to identify the major components of the curricula of the disciplines specified for this project (physician assistant, dietetics, medical technology, occupational therapy, physical therapy, radiologic technology, and respiratory therapy). Furthermore, the objectives of the Project required that the curricular data be linked to the test item library. This latter requirement was satisfied with the development of the curricular matrix.

Thus, the basic threefold purpose of this project included: 1) development of a computerized test item library from which Profile Examinations could be generated, 2) a review and analyses of curricula for the allied health groups and 3) assessment of the reliability and validity of the Profile Examinations. Methodology to achieve these objectives follows.

Methodology

The University of Missouri-Kansas City represented a singular opportunity for system development. The School had initiated a system by which medical students were required to take a Profile Examination on a quarterly basis throughout their six-year program. This probe of informational content delineated strengths and weaknesses throughout their educational process. The item library, at the heart of this computer-assisted test construction system, contained questions pertinent to the basic and clinical sciences of medicine. Systematic samples of the item library were used for Profile Examinations, self-learning and assessment, and instructional pre- and posttests. Recapturing an original purpose of the project; refinement, enlargement, and sophistication of the computerized test item library for assessment of physician extenders was based on the development of the test item library used to generate Profile Examinations for medical education. Otherwise, achievement of the Project's goals would have been extremely difficult to accomplish. Thus, the system at the University of Missouri-Kansas City served as a model, philosophically and methodologically, for fulfillment of the Project's purpose.

Computer System and Hardware

The computer system has several major components. The complete system, with supporting documentation, is available in computer readable format. Appendix A contains detailed discussions on the various components which constitute the Profile examination system.

Early in the project's development, it was apparent that a flexible system was needed, one which would allow for growth and facilitate analysis of data. End results have provided a "search" program which can retrieve questions based on any data element provided in the test questions or almost any conceivable combination of elements. Programs provided for adding questions to the data base, an on-line, real-time system to update and modify the questions, and a "closed-loop" testing system where questions are selected for an examination, the results determined and the newly acquired data placed back in the appropriate questions. A separate system creates and maintains the Curricular Matrix and there are associated programs to handle the general maintenance and integrity of the system as a whole.

The computer system was built upon a computing base within the University of Missouri's computing system. Since the design took into account that a computing utility would be used rather than an "in-house" computer, the system is adaptable to either environment, which makes replication easier.

Question Generation

As previously stated, a basic philosophical assumption was made at the onset that basic medical knowledge should be the same for any health professional, as individual tasks are discharged at defined levels of responsibility. By design, the test item library was developed to accommodate an ultimate body of multiple-choice test items relating to medical education; therefore, not all questions of the item library are pertinent to the Physician Assistant. Those items appropriate to the education of the Physician Extender were assigned a specific code in addition to the codes for medical subject specification. Those items specifically related to the physician assistant can be retrieved.

Items were generated from many sources according to guidelines attached in Appendix D. The Project Director, who is a physician, and an Assistant to the Project Director, who had been a basic science instructor in a physician assistant program, designated which questions were relevant to the physician extender portion of the item library. Approximately 36% of the total number of items were designated relevant to the physician assistant student. Through additional review many more are possible. Each item went through several steps of generation before entering the item library. See Figure 1 below.

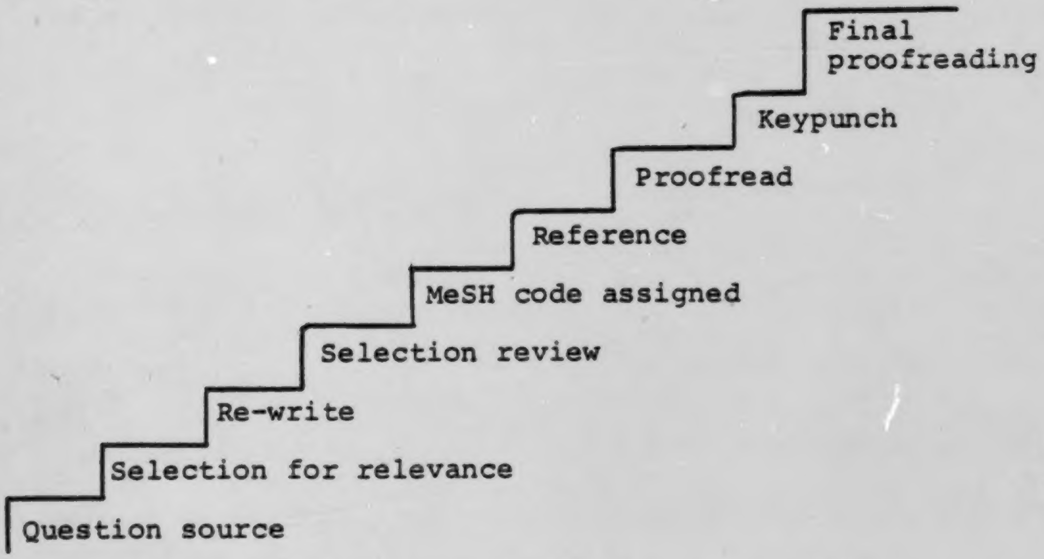

Figure 1. Steps in Item Generation

The number of different sources of test items was quite large and represents diversity of background. One hundred and fifty sources generated the test items. Upon receipt, items were selected for relevance and sent to the item editor for possible revision. Another selection review occurred to assess the applicability to the physician assistant curriculum. Then, the Medical Subject Headings (MeSH; Chapter 4) were assigned and a specific reference to a current journal or textbook citation was verified. In many cases the reference had to be changed or added. Proofing the question occurred before the keypunch operation. A final proofreading took place before entry into the item library.

Review of curricular literature

Literature published within the past five years relating to the physician assistant and six allied health professions was reviewed. From this review, articles in which the primary focus was on curricula, certification, or evaluation were selected for inclusion in the Bibliography, arranged by discipline. This Selected Bibliography is Appendix B.

Design of curricular and educational matrices

Detailed outlines of subjects within all of the basic sciences and medical sciences were prepared to provide for recording data obtained from institutions offering programs in the specified allied health professions and for the physician assistant. As described in Chapter 3, Analysis of Curricular information was gathered from specific course outlines, interviews, program descriptions, and college bulletins. A computerized curricular matrix was designed to display this curricular data from which the educational matrices were prepared. The curricular matrix was designed to provide a useful link and framework for generation of questions needed for the Item Library and test construction as well. (Chapter 4, Test Construction.) Computer programming was accomplished which allows for conducting an inventory of the item library using the curricular matrix as the organizational scheme.

Data from curricular analyses were used to form educational matrices which are graphic presentations of the major subject components of the curricula of the disciplines specified by this project. The educational matrices display two types of information; 1) Arrangement by discipline, with Class Hours shown for each of ten general subject areas, Figures 3 - 9, (Chapter 3), and 2) Arrangement by general subject area, with Class Hours shown for each of the disciplines, Figures 10 - 19 (Chapter 3).

Design of psychometric studies

Psychometric analyses were conducted to assess the reliability and validity of Profile Examinations generated by the computer-assisted test item library and test construction system. The capabilities of the system and the characteristics of the evaluation process at the University of Missouri-Kansas City provided the opportunity for initiation of psychometric analyses at the onset of the contract period. Through the use of data collected by administration of Profile Examinations to a large group of examinees, it was possible to test the ability of this system to generate reliable and valid examinations.

Substantial item analysis data were collected during the contract period. The proportion of examinees choosing each test item's answer alternatives was obtained for several levels of education. An index of item reliability was computed using the point-biserial correlation of item and total scores.

The use of Kuder-Richardson, formula 20, method for computing reliability of profile examination scores was well suited to this application. The Kuder-Richardson, formula 20, provided a measure of internal consistency which, according to a derivation by Kaiser and Michael (1975) can be interpreted as the coefficient of domain validity or, to use other terms, the coefficient of generalizability. Reliability studies are reported in Chapter 5.

Numerous studies of validity were designed and are reported in Chapter 5. Construct, concurrent, and predictive validity studies (Anastasi, 1976) were accomplished using data of medical, allied health, and physician assistant students. Content validity was a basic concern. Another essential test of validity was the determination of the Profile Examinations' sensitivity to differences in the information base of individuals and groups across the various content categories.

Field Testing

Consistent with goals of the project, ultimate target groups for examination included individuals enrolled in physician assistant programs. The Profile Examinations generated for such groups were designed to cover the content of the physician assistant curriculum. Considering the intended examinee groups and the design of Profile Examinations for Physician Extenders, it was necessary to field test the system with physician assistant students, as well as students and professionals of other allied health areas. Field testing was designed to assess the appropriateness of content for physician assistants, to assess the sensitivity of Profile Examinations to changes in information base, and to assess in a limited manner the overlap of information base of the various allied health professionals with that of the physician assistant. Details of field testing results are illustrated in Chapter 2 (Summary and Recommendations) and in Chapter 5 (Test Analysis).

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Chapter 2

SUMMARY AND RECOMMENDATIONS

The Product of the PEPE project is a system, not a single examination. This system enables one to conduct a curricular content analyses, generate examinations of curricular content, and make individual curricular prescriptions for physician assistant programs. Additionally, the system may be used for internal evaluation of individual performance, assessment of curricular effectiveness and self-instruction. The diagram below illustrates the general cycle of the system.

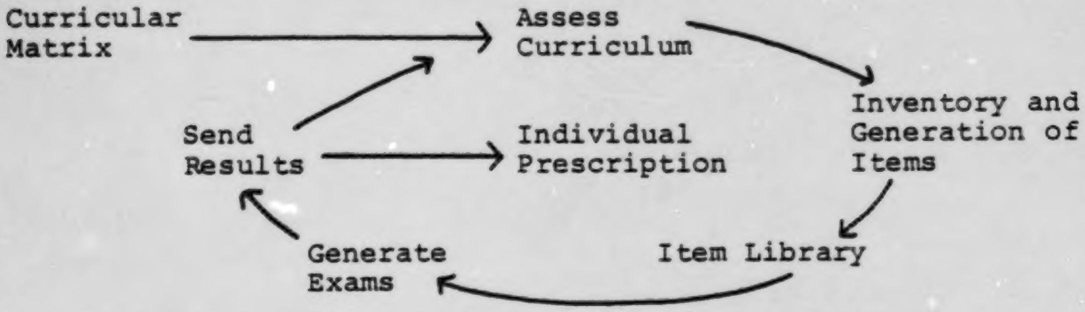


Figure 2. Diagram of the Profile Examination System

Data of curricular (Appendix C) matrix may be used as reported or it may be used to assess the content of a particular curriculum. Having documented or cataloged the curricular content, an inventory of items would be conducted to determine the adequacy of content coverage. The system allows for generation of items which might be needed to satisfy a particular program's needs. Items were stored in the computerized library in a manner which allows for retrieval in a systematic sample according to content specifications. The generated examination could then be administered and scored. Results are intended to be consumed by the individual for purposes of curricular prescription and by faculty for purposes of curricular assessment.

A computer-assisted test item library has been developed containing over 10,000 multiple-choice test items, whereby probes for informational content can be utilized for medical education, physician extenders, and allied health personnel. As originally conceived, within the scope of work, the computer programs were designed so that replication could take place if desired. As noted in the section on computer programs, over 50 programs and more than 11,000 lines of code are now operational on the computer network of the University of Missouri. Since the design took into account that a computing utility would be used rather than an "in-house" computer, the system is easily adaptable to either environment, which should make replication easier.

During the first year of the project and concomitant with development of the test item library, identification of educational and training standards for physician assistants and selected allied personnel was undertaken. As noted in this section, the curricular analyses led to the development of a curricular matrix programmed into the computer system. There was no intent to identify quality of educational content, but to quantify on a national level, content of instructional hours for selected allied health professions which could interface with the profile for physician extenders and the ultimate test item library which probes for strengths and weaknesses of informational content. It should be noted that the format of the matrix is flexible and will accommodate additional data from the programs identified to date. It should have applicability in analyses of other types of educational programs or subject arrangements. To understand the matrix display, it should be pointed out that curricular data were displayed with MeSH codes which form a fundamental framework for utilization of this test item library.

Problems in the past with computerized test construction have related to a classification scheme by which items are stored and retrieved. The development of an adequate taxonomy is a task of considerable proportion. In many cases developers of computerized test systems have attempted to develop their own taxonomy only to realize its inadequacy at a later date. Since a good retrieval system is crucial to any electronic data storage project, it was decided that the Medical Subject Headings and codes developed by the National Library of Medicine have stood the test of time and were very appropriate for the needs of the project. MeSH was chosen as the indexing and searching vocabulary for the Item Library over other thesauri because it is more comprehensive in providing terminology for the entire field of medicine and related disciplines. Thus duplication of expenditure of resources for development of a taxonomy was avoided.

Test construction and test analysis were an essential and ongoing part of the project, utilizing Profile Examinations as a base instrument by which extraction of items for physician extenders could be obtained. Ultimate measurement of informational content for the allied health professions can be compared with this data. The computerized item library was developed in such a manner that it is possible to construct examinations of varying lengths and content. Chapter 4 describes in detail the procedures for construction of profile examinations.

There also exist a number of possible formats for objectively scored questions. Even the most common form, multiple choice, has several possible forms. After considering what impact on programming needs and statistical results might occur as a consequence of various forms of multiple-choice questions, a decision was made to seek and revise questions consistent in format. Test questions in this item library have a clear opening statement, the question stem, and five substantive answer choices, with one correct answer. Each question is referenced to a standard medical text or medical journal.

It should be remembered that while a substantial number of multiple-choice test items were grossly available at the beginning of the project, no resources had been available to critically analyze format and to review content and statistical reliability continuously. The project provided these resources, which were outlined in the original scope of work. Test committees were established, and detailed initial review with item editing occurred. Thus, inconsistency of format was not a significant variable as ultimate measurement of information was implemented. In addition, ongoing review related to test item duplication and item analysis, was essential. As feedback from review occurred, decisions had to be made regarding retention or alteration of item analysis data. Computer programs were adapted for retention, deletion, or alteration as review was accomplished. This is reviewed in some detail to point out the intricate tasks involved in test item generation as well as to emphasize the process used to build up a test item library of over 10,000 questions during the project period. At the same time that the item library was developed, access to data collected through administration of Profile Examinations to students at the University of Missouri-Kansas City School of Medicine was fundamental for continuous "field testing" of library additions. For example, pertinent data were collected for 4,800 test items through this resource. Through longitudinal testing of the student body the number of examinees was equivalent to 4,380. Detailed discussion of psychometric studies is given in the chapter on Test Analysis. The overriding fact is that the test item library and profile examinations have proved to be reliable instruments for measuring information.

Field testing for the Profile Examination for the Physician Extender (PEPE) began during the second year of the project and first occurred at Sheppard Air Force Base. A group of students who had just completed their didactic experience was given PEPE 1 and PEPE 2 examinations. The numerical sequence of PEPE 1 and PEPE 2 simply relates to extraction of 400 different multiple choice test items from the item library for each examination. These examinations theoretically had sound psychometric principles of measurement for curricular content for physician assistants. The mean performance of PEPE 1 and 2 fell near the projected mean performance of Year 3 medical students in the University of Missouri-Kansas City School of Medicine. These projected means were based on item analysis data of those items which had appeared on previous Profile Examinations.

Subsequently PEPE 1 and 2 examinations were administered to students just entering the didactic program at Sheppard

Air Force Base. The mean performance of this group of students fell into the projected level of Year 1 medical students at UMKC. Graphs presented in the Test Analysis section (pages 61 and 62) give a visual representation of the pre- and post-didactic scores. The graphs depict the gain in information which occurred as a function of completing the Physician Assistant Program. In particular, the gains were substantial in the area of General Medicine and the Basic Science areas of Physiology, Biochemistry, Anatomy, and Pharmacology. In a subsequent longitudinal pre- and post-test study, a group of physician assistant students demonstrated a similar pattern. The Profile Examinations were able to measure gain of information which resulted from their educational experience.

Since this was the first PEPE field testing experience, a questionnaire was given each examinee upon completion of the examination. While details of the questionnaire are outlined in the Test Analysis chapter, it is significant that the students felt 80% of the test items were relevant to their curriculum.

One of the most difficult logistic parts of the project related to securing students in the allied health professions who were willing to field test the PEPE examination. The reasons were straightforward. Allied health professional students were very apprehensive about taking a difficult examination which covered curricular areas in which they felt unfamiliar. With persistence, however, a sufficient population pool was obtained to demonstrate the validity of our item library and instruments.

As an example, 53 respiratory therapy and radiologic technology students took PEPE 1 and 2 at Ferris State College, Grand Rapids, Michigan. It should be noted that these students were still in their respective educational programs at an undergraduate level. As also noted in the test analysis results (Tables 10 and 11; Test Analysis, page 63) the scores were understandably low compared to medical students and physician assistants who had completed their didactic experience. Emphasis should be placed on the fact that the field test examination was a difficult examination for allied health students not previously exposed to a broad medical educational experience. Additional field test experience documented what the project, its system, and instruments were designed to do. To illustrate this point, allied health scores (respiratory therapy and radiologic technology) were compared to physician assistant students who were at the beginning of their didactic experience. The overall mean scores of respiratory therapy and radiologic technology groups did not exceed that of beginning physician assistant students. However, the mean scores of respiratory therapy groups did significantly exceed mean scores of beginning physician assistant students in the categories of physiology and anatomy (Table 12; Test Analysis, page 64), respectively. These results demonstrated the validity of the concept that overlap of core information exists in some content areas and the validity of the Profile Examination as a means of assessing base information. Further examples substantiated this concept in field testing experience with 63 allied health students at the University of Missouri-Columbia and the University of Kansas. See Tables 13 and 14; Test Analysis, page 68. As noted, medical technologists scored very well in microbiology, and dietitians scored exceedingly well in biochemistry. It is interesting to note that biochemistry scores for the dietitians fell at the level of Year 6 medical students at the University of Missouri-Kansas City.

Minimal attention has been given in this summary to the computing aspect of this project. Reliable storage, retrieval, and analysis of data played a fundamental role in the success of the project, which is described in detail in the section on Computing Activity. Attention should be called again to the fact that the computing activity is replicable which is consistent with an original objective.

Recommendations:

1.) The Profile Examination System should be used as a reliable method for periodic internal evaluation. It should not be looked upon as an external certifying instrument(s).

2.) While probes for informational base in any subject(s) area can be of varying length (number of questions), sound psychometric principles must be used, as information is delineated from any examination at any given point in time.

3.) Before utilizing the test item library in generating examinations for any given health professional program, an individual curricular analysis (by appropriate faculty) should be compared with the curricular matrix. It is important to have faculty involvement in all aspects of the system.

4.) The curricular matrix provides a fundamental framework by which health science programs within one institution can be compared, or where individual programs can be compared to other institutions. It can provide useful information for identifying curricular overlap.

5.) While the computerized test item library contains a substantial number of test items (over 10,000), it should not be viewed as a static instrument. Ongoing review is essential for the library to remain responsive to its purpose. Continuous tests for reliability, validity, and item analysis are fundamental to the library's use. Furthermore, a team of knowledgeable people in test construction and design are very important as informational results are interpreted.

6.) The Profile Examination System can be an important adjunct in assessment for continuing education. While items and analyses developed for this project related primarily to undergraduate medical and allied health education, principles and features of the system can be readily transposed to continuing education at the graduate level.

7.) Medical Subject Headings (MeSH codes), developed by the National Library of Medicine, provided a comprehensive and satisfactory indexing and searching vocabulary for the computerized test item library. MeSH codes avoided duplication and expenditure of resources for the development of a taxonomy.

8.) Intra and inter-institutional sharing become increasingly important as educational resources address all issues relating to health manpower. A system for measuring medical information, as developed in this project, is in reality a continuous effort. A significant nucleus has been provided during a three-year period. Resources will probably never be available to provide individual institutions with their own elaborate system for internal evaluation. Mechanisms and resources should be found to provide for institutional sharing so that systems for internal evaluation can be preserved.

Chapter 3

ANALYSIS OF CURRICULA

An objective of the PEPE Project has been to identify educational and training standards of the physician assistant and six allied health professions. The analysis of curricula has led to the development of a computerized curricular matrix. The matrix is an outline of the subject content areas of medicine and the basic sciences. A copy of the matrix accompanies this report as Appendix C.

The matrix provides for coordination of subjects within the curricular outlines and the test item library. The subjects included in the matrix are accompanied by the specific search statements (MeSH codes and combinations of MeSH codes) used to query the computer and automatically identify the number of questions available in the item library. This information also provides for identification of subjects for which questions need to be generated.

The remaining columns of the curricular matrix display the number of class hours and the percentage of the major areas of the curriculum which the more specific concepts represent. The class hour data were obtained from a combination of university bulletins, individual course outlines, and discussion with faculty representatives. In order to quantify the varying curricular information, the following common denominator was used: one class hour refers to one hour of scheduled class or laboratory time; one semester credit is the equivalent of fifteen class hours; one week of clinical rotation is the equivalent of fifteen class hours.

Curricular data were stored for two physician assistant programs and two programs from each of the following disciplines: dietetics, medical technology, occupational therapy, physical therapy, radiologic technology, respiratory therapy.

The format of the matrix is flexible, and it will accommodate additional data. The subject outlines could be written with more specific detail or could be reduced to include only general subject areas. Data from additional institutions for each of the disciplines could also be added to the matrix. The matrix may have applicability in analyses of other types of educational programs or subject arrangements. By using the curricular data as a framework, profiles of the information base of any of the selected professions can be prepared and compared with performance on examinations such as those generated for the field testing of this Project.

Data provided by analyses of the curricula were used to form educational matrices of the major subject areas included in the curricula of the specified disciplines. The educational matrices exhibit data which were derived by averaging the number of class hours for each subject from two institutions for each profession. Major components of the curriculum, including both basic sciences and medical sciences, for the physician assistant are shown in Figure 3. These ten general subject areas are repeated in Figures 4 - 9 for each of the six allied health disciplines for which curricular information was obtained.

A rearrangement of the data to show the class hours devoted to each major subject by the seven disciplines studied is presented in Figures 10 - 19. These graphs illustrate overlap within major areas of curricular content of the designated allied health fields. Figure 10 for Anatomy and Physiology indicates that the physical therapy curriculum includes more class hours than that of the physician assistant and the occupational therapy curriculum includes nearly an equivalent number of hours. Figure 11 shows that the dietetics, medical technology, physical therapy, and respiratory therapy curricula provide for more class hours in Chemistry than that of the curriculum for the physician assistant. As shown in Figure 12, the medical technology curriculum includes considerably more microbiology than any of the professions, and the dietetics and respiratory therapy curricula include class hours equivalent to that of the physician assistant. Pharmacology, Figure 13, is the only one of the basic sciences for which none of the selected allied health professions have an amount of education comparable to that of the physician assistant. Figure 14, Behavioral Sciences, indicates that the dietetics, occupational therapy, and physical therapy curricula have more training in the Behavioral Sciences than the physician assistant curriculum, and the respiratory therapy curriculum has an equal amount.

As shown in Figure 15, Laboratory Medicine, only the physician assistant and medical technology curricula include significant numbers of class hours in this area, and the medical technology curriculum provides considerably more time than the physician assistant curriculum. A major portion of the physician assistant curriculum is devoted to General Medicine, Figure 16. Although none of the curricula of the selected allied health fields approach the physician assistant in terms of number of class hours in General Medicine, Medicine is a major part of the respiratory therapy curriculum, and the dietetics and physical therapy curricula also provide a significant number of class hours in the area. For the other clinical areas identified in the educational matrices, Obstetrics and Gynecology, Figure 18, Pediatrics, Figure 19, and Emergencies, Injuries, and Surgical Procedures, Figure 17, only the curriculum of the physician assistant includes a sizable number of class hours.

Analysis of curricula is a foundation for development of an individual curricular prescription related to prior educational experiences and goals for career changes. It is the conncecting element between the profile examination system and the objective of granting credit for information previously obtained.

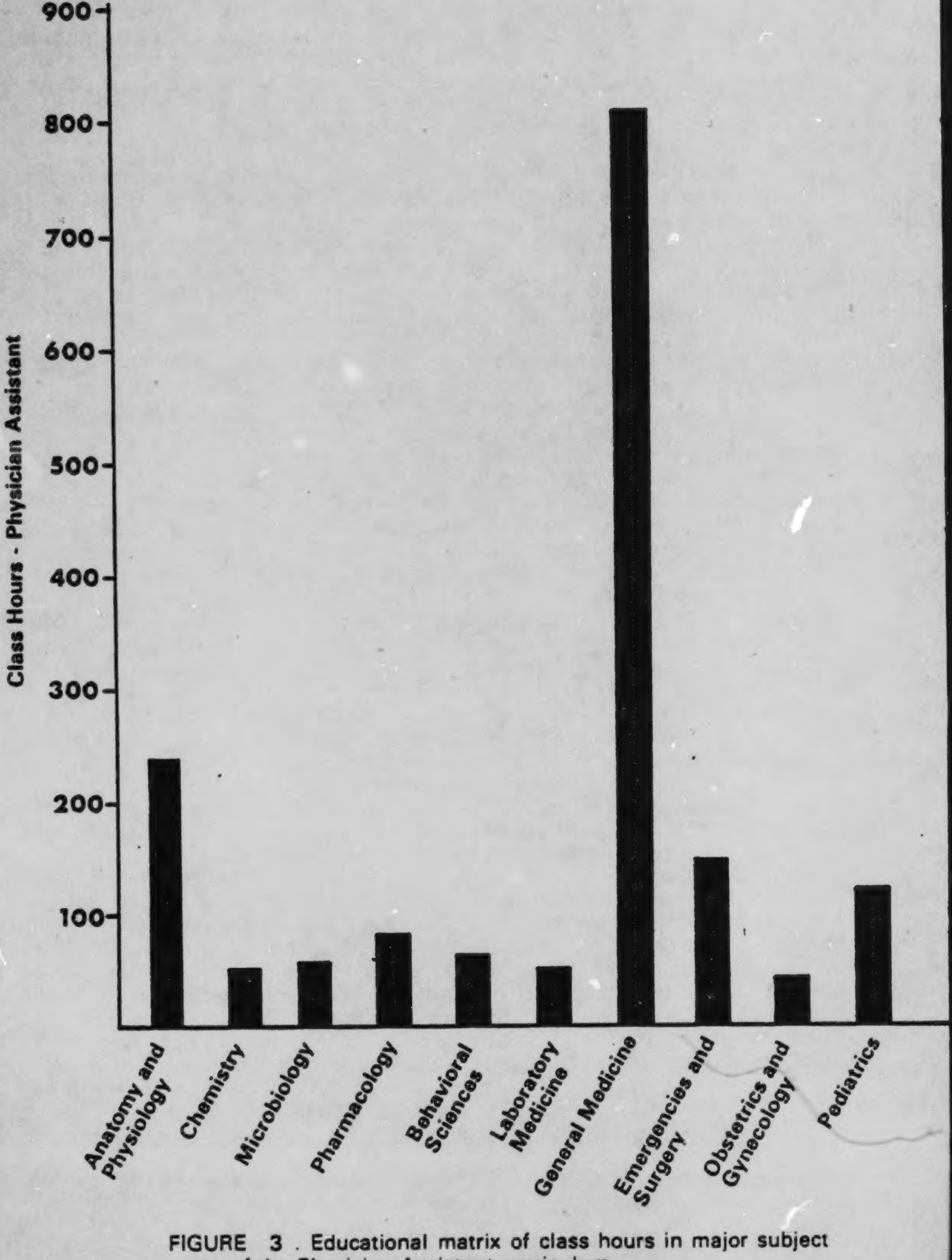


FIGURE 3 . Educational matrix of class hours in major subject areas of the Physician Assistant curriculum.

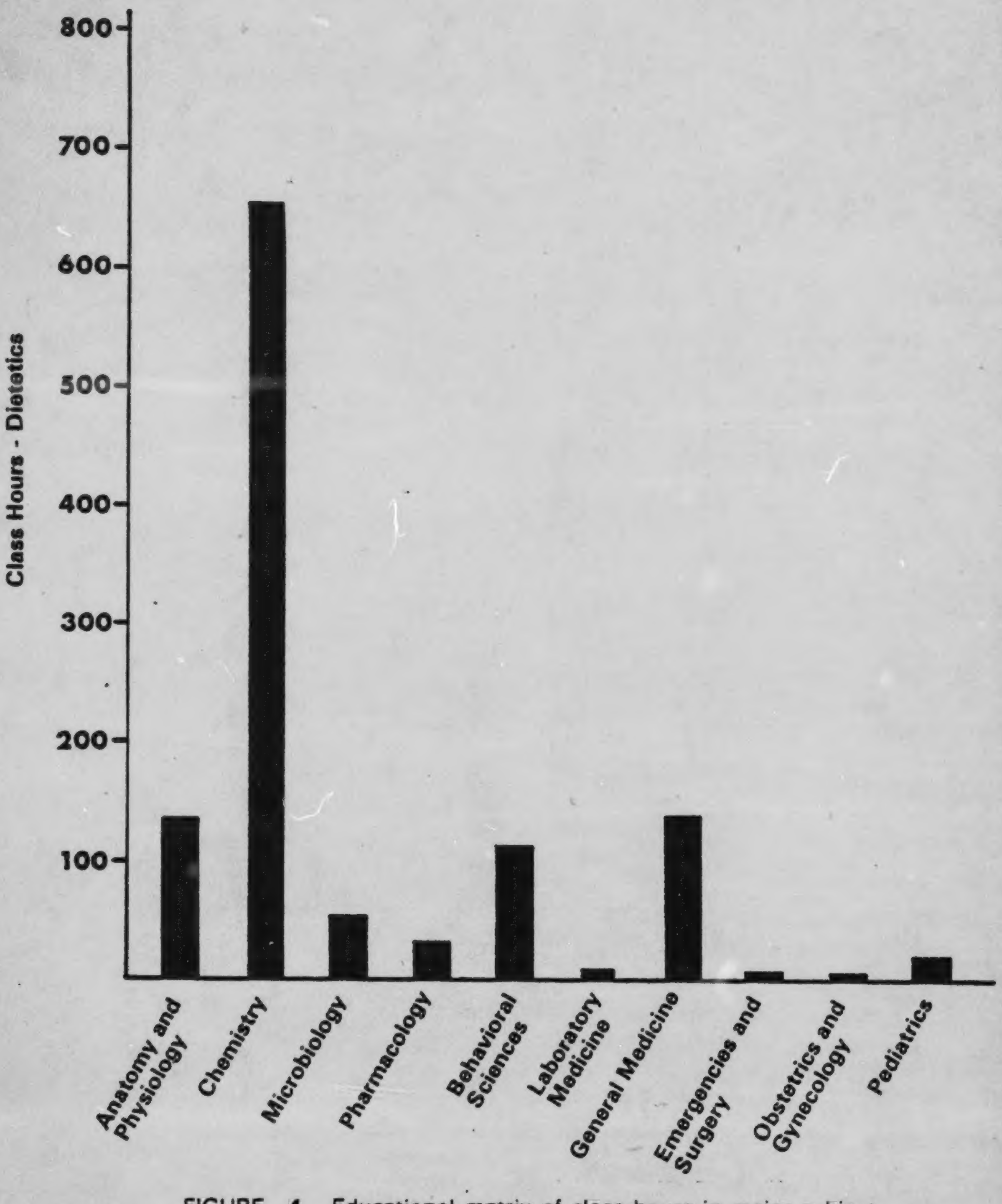


FIGURE 4 . Educational matrix of class hours in major subject areas of the Dietetics curriculum.

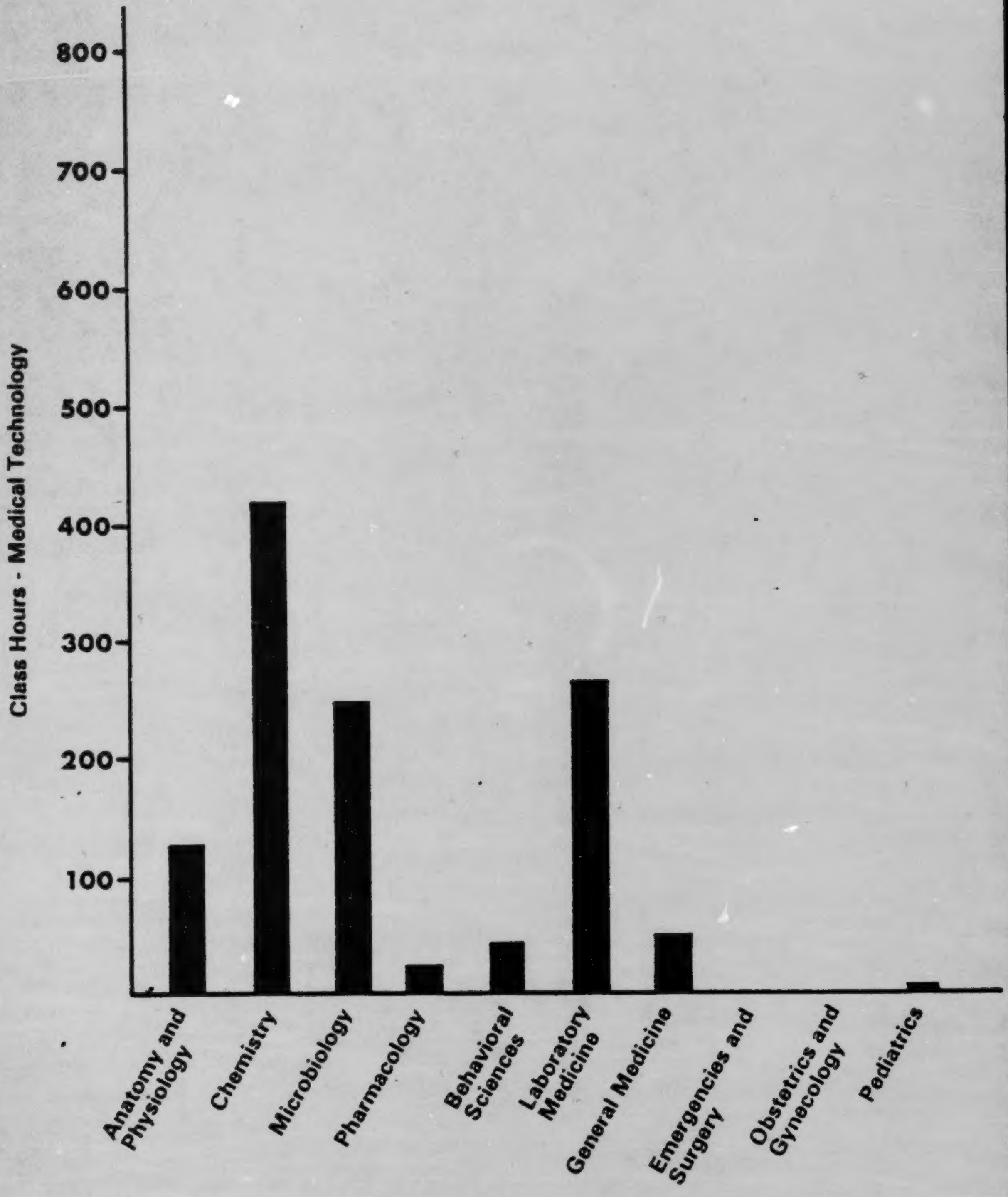


FIGURE 5 . Educational matrix of class hours in major subject areas of the Medical Technology curriculum.

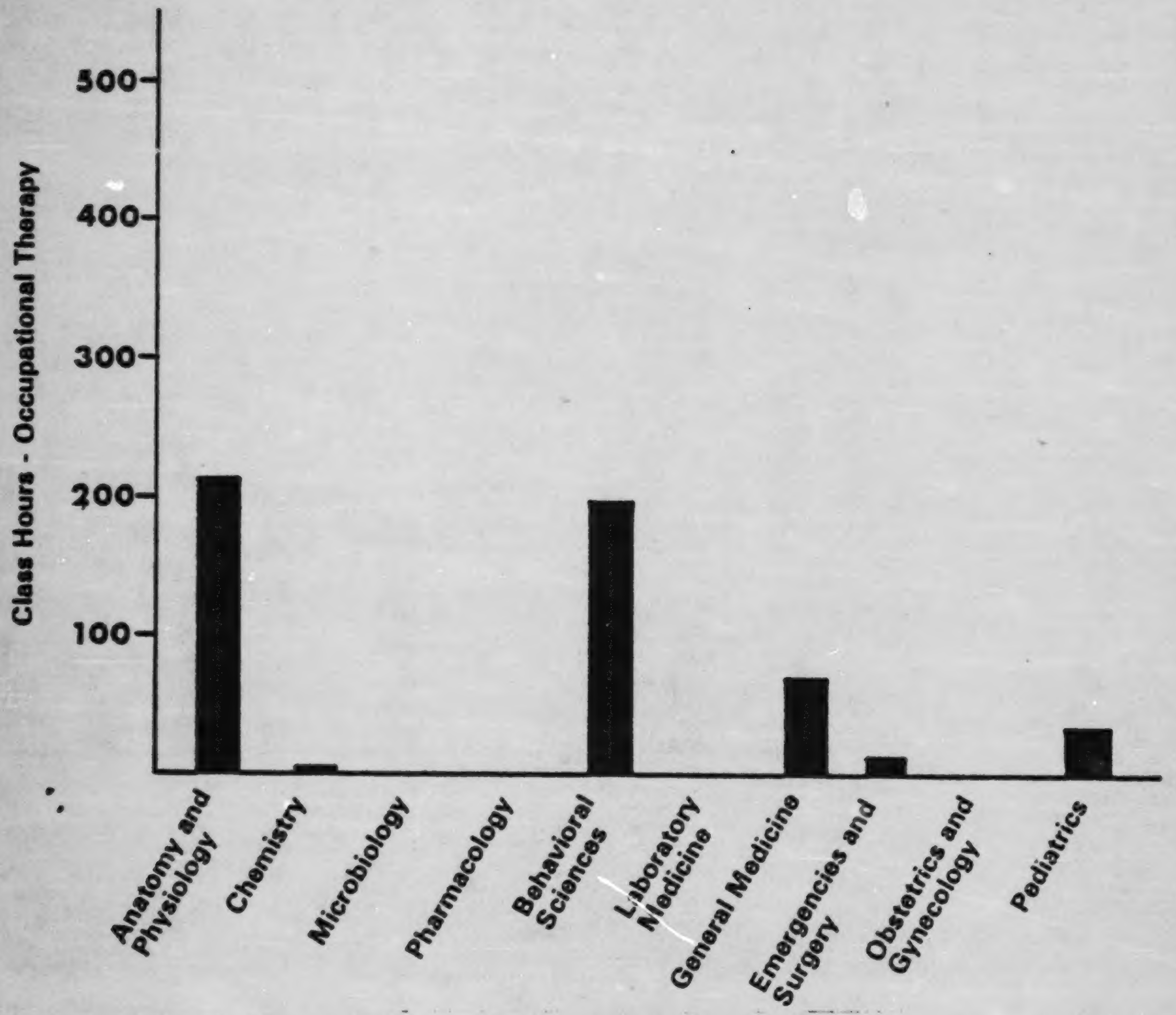


FIGURE 6 . Educational matrix of class hours in major subject areas of the Occupational Therapy curriculum.

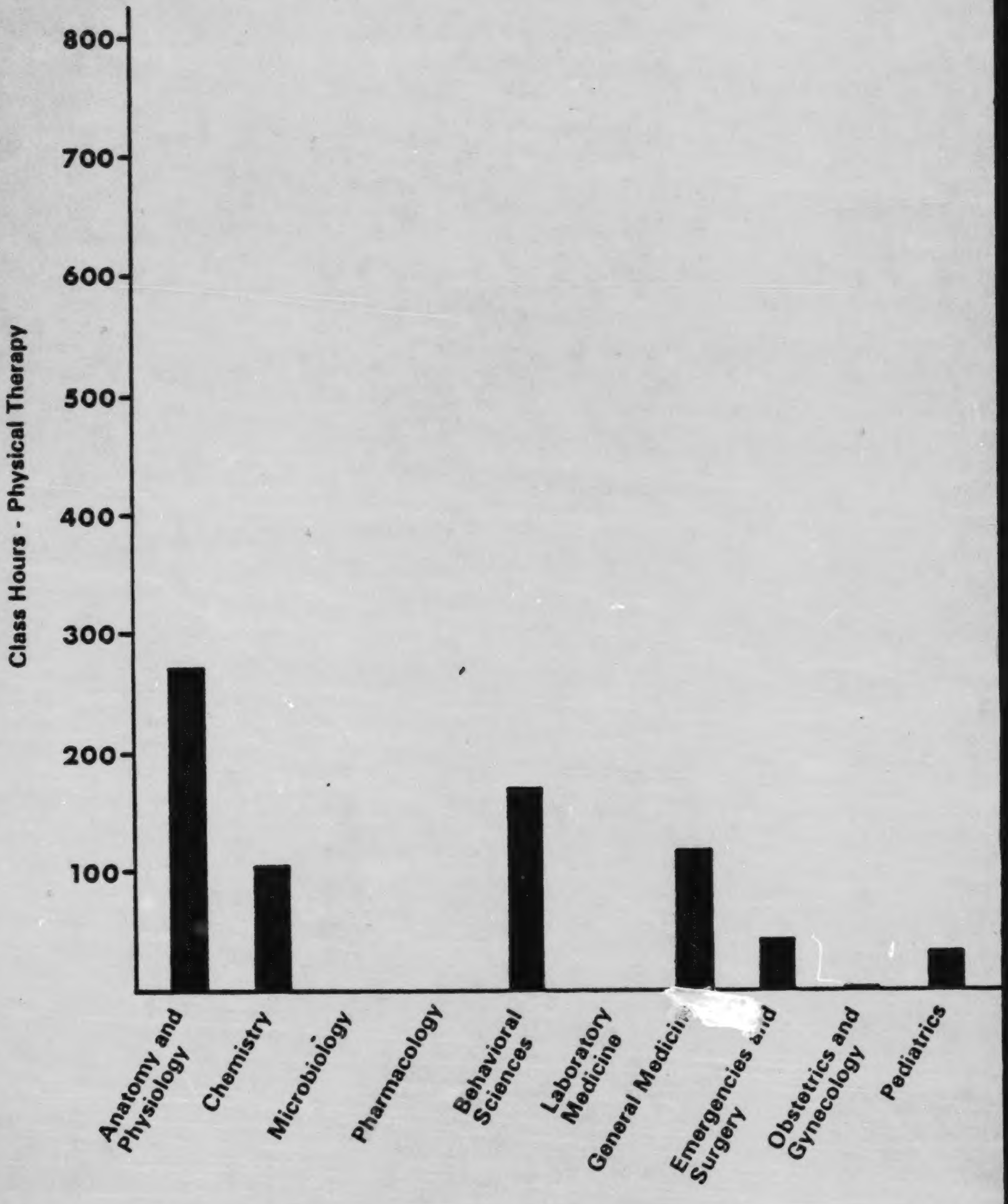


FIGURE 7 . Educational matrix of class hours in major subject areas of the Physical Therapy curriculum.

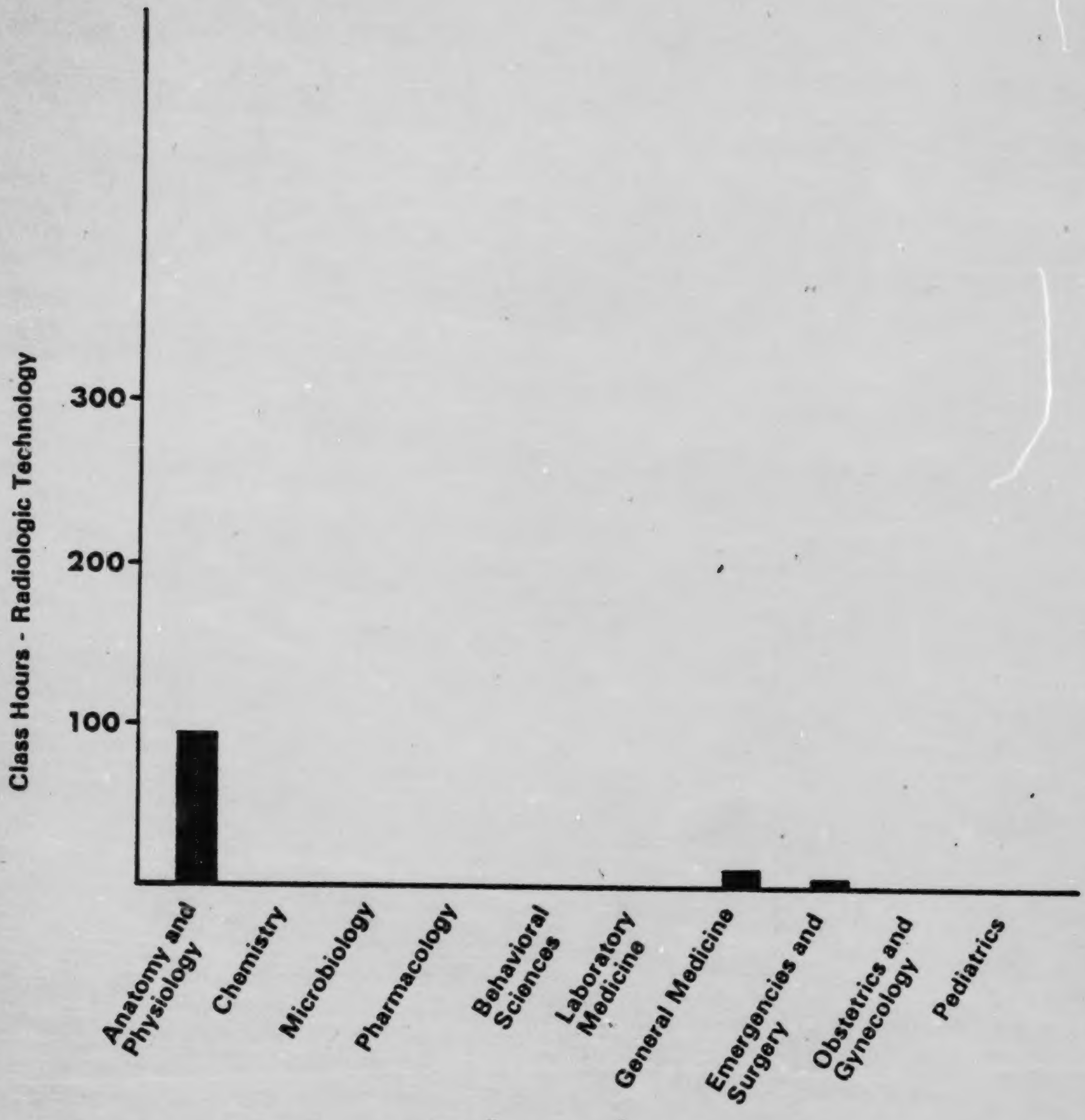


FIGURE 8 . Educational matrix of class hours in major subject areas of the Radiologic Technology curriculum.

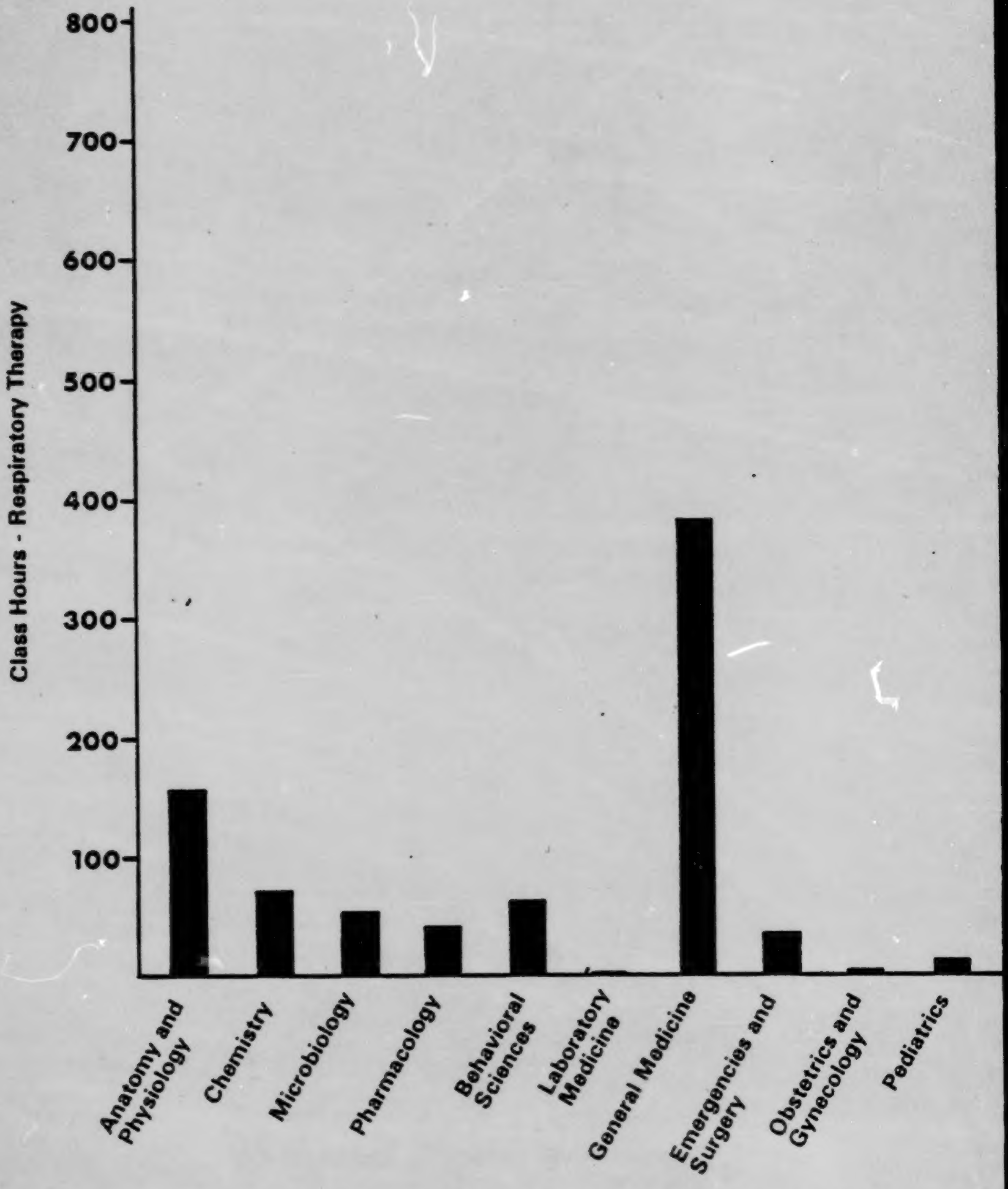


FIGURE 9 . Educational matrix of class hours in major subject areas of the Respiratory Therapy curriculum.

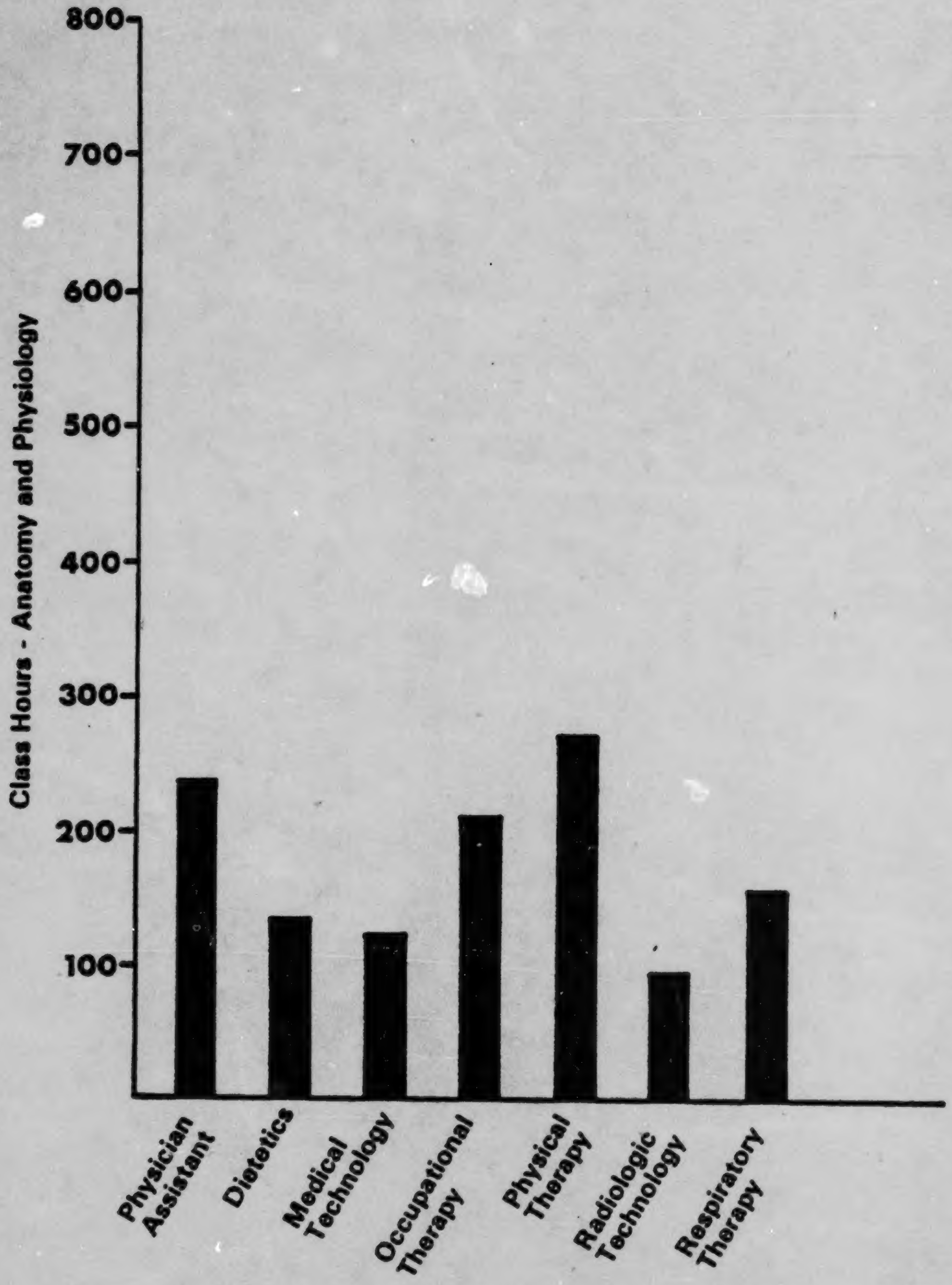


FIGURE 10 . Educational matrix of class hours in Anatomy and Physiology for six allied health professions and the physician assistant.

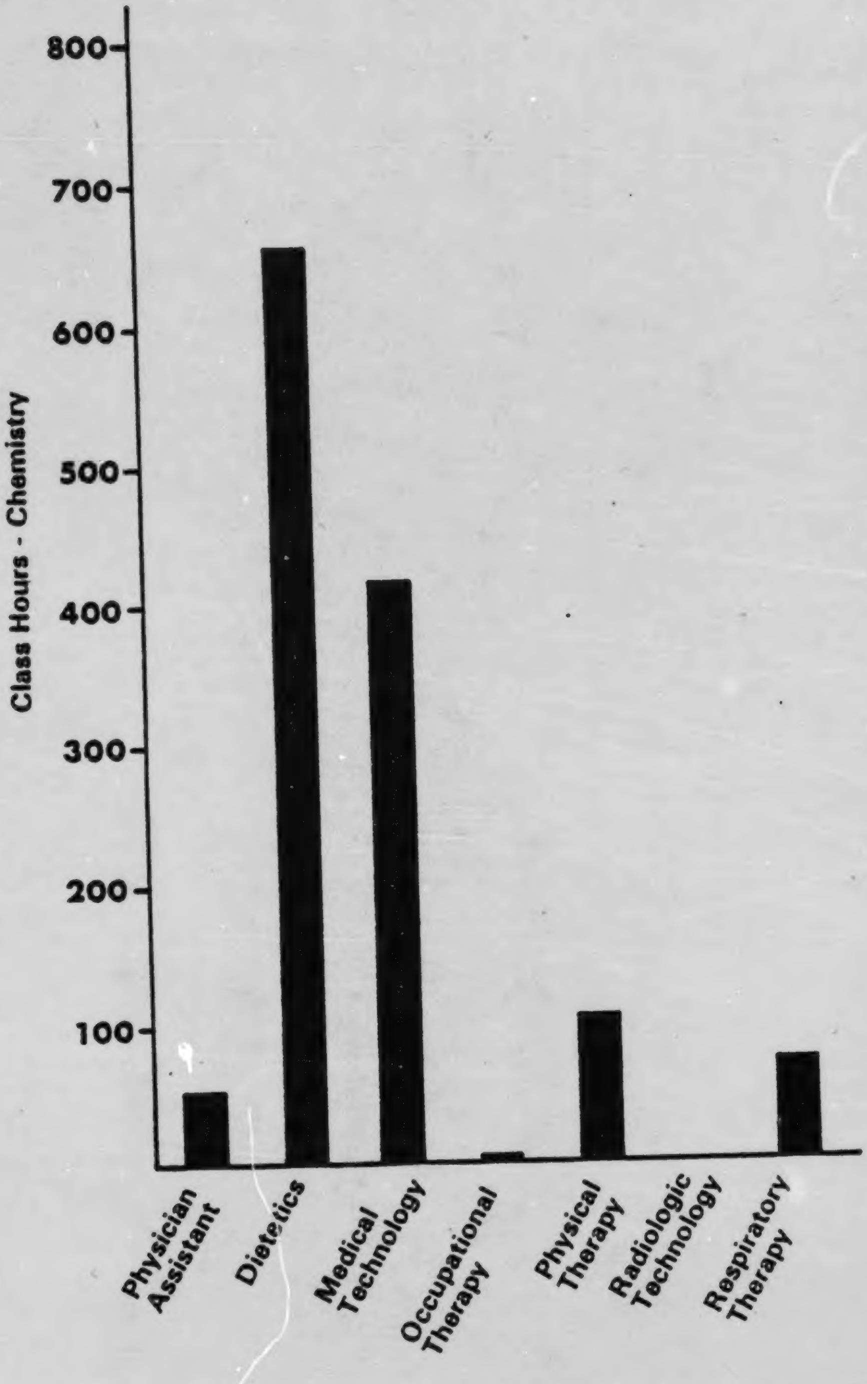


FIGURE 11. Educational matrix of class hours in Chemistry for six allied health professions and the physician assistant.

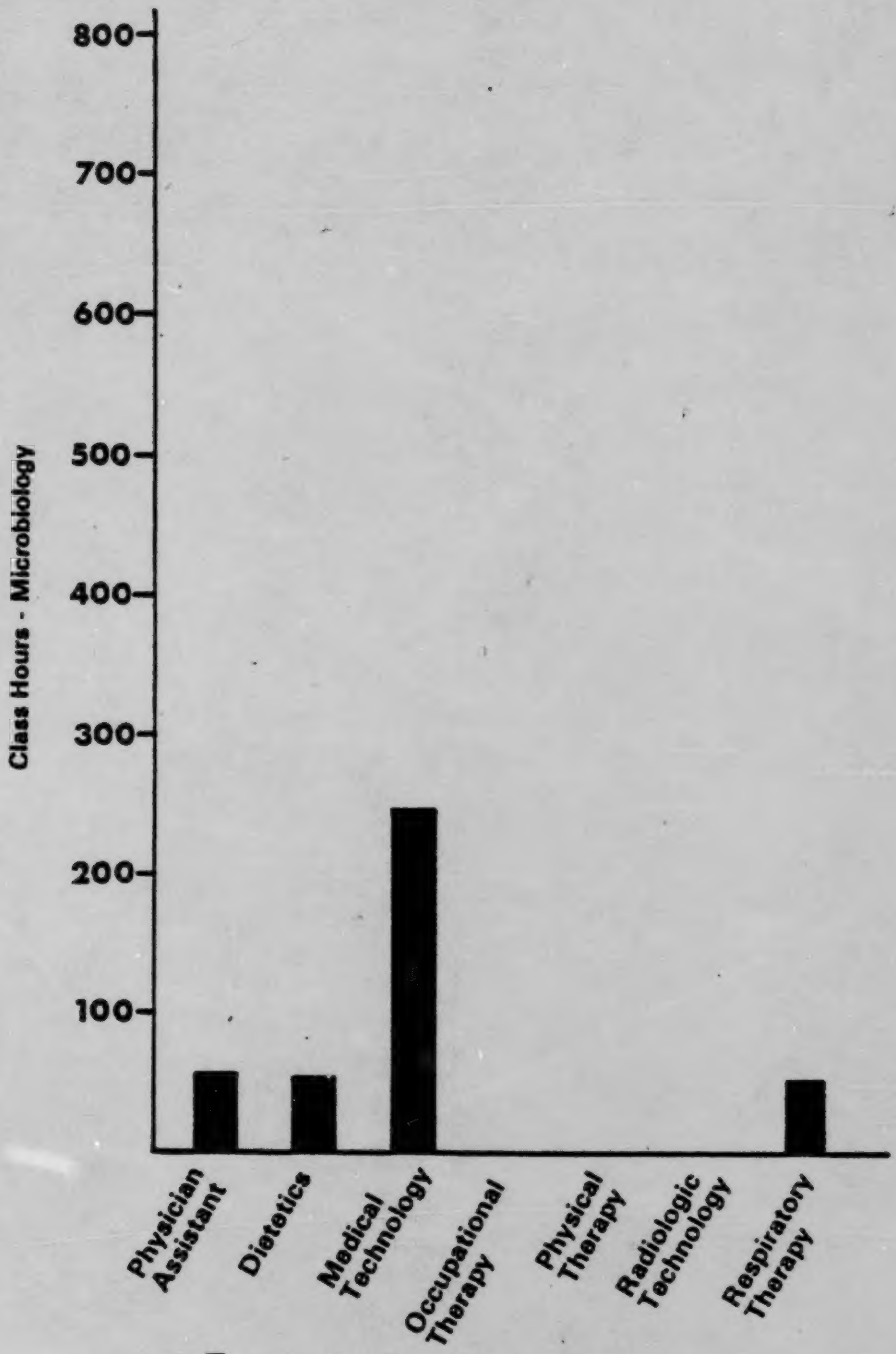


FIGURE 12. Educational matrix of class hours in Microbiology for six allied health professions and the physician assistant.

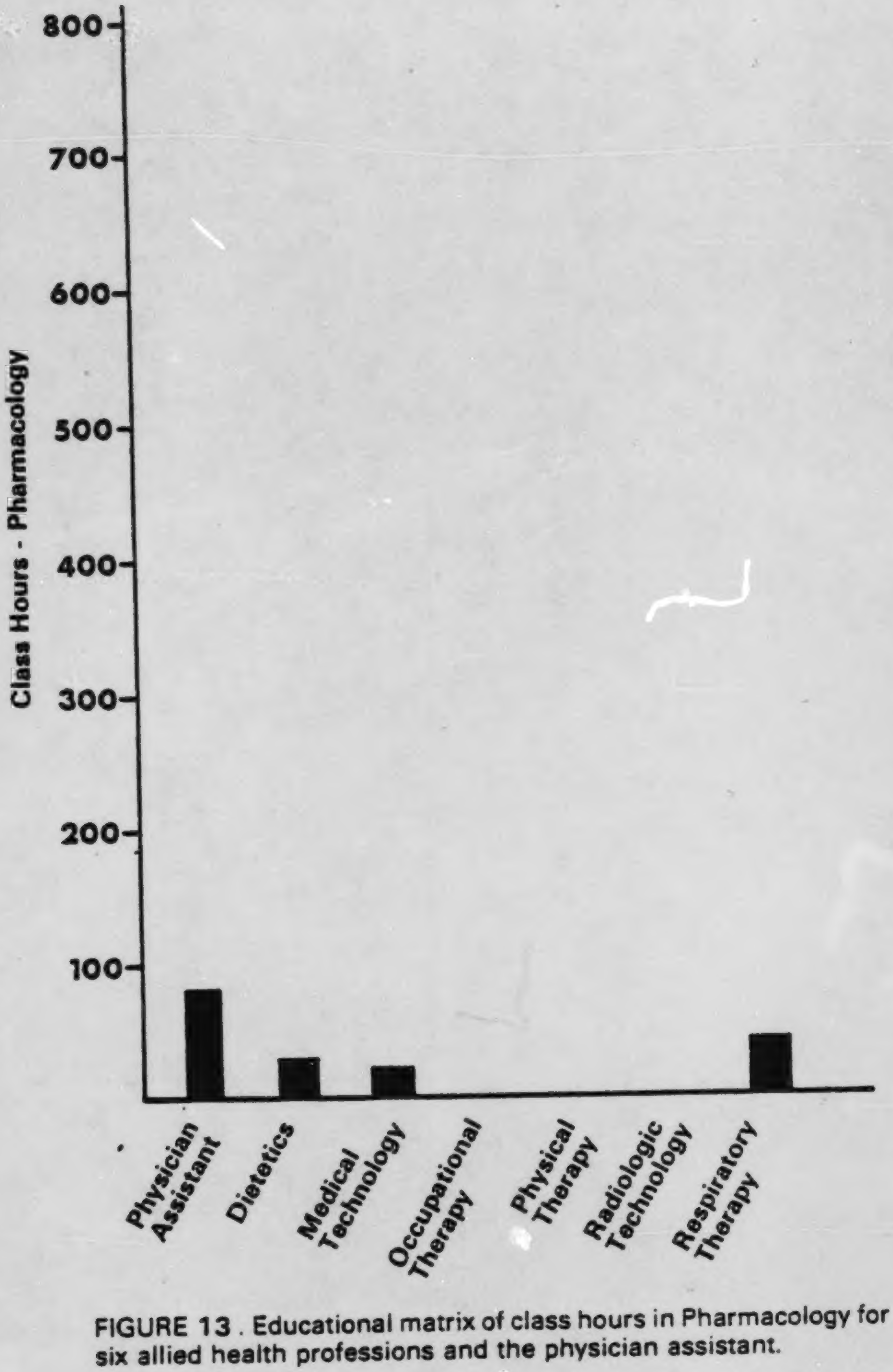


FIGURE 13 . Educational matrix of class hours in Pharmacology for six allied health professions and the physician assistant.

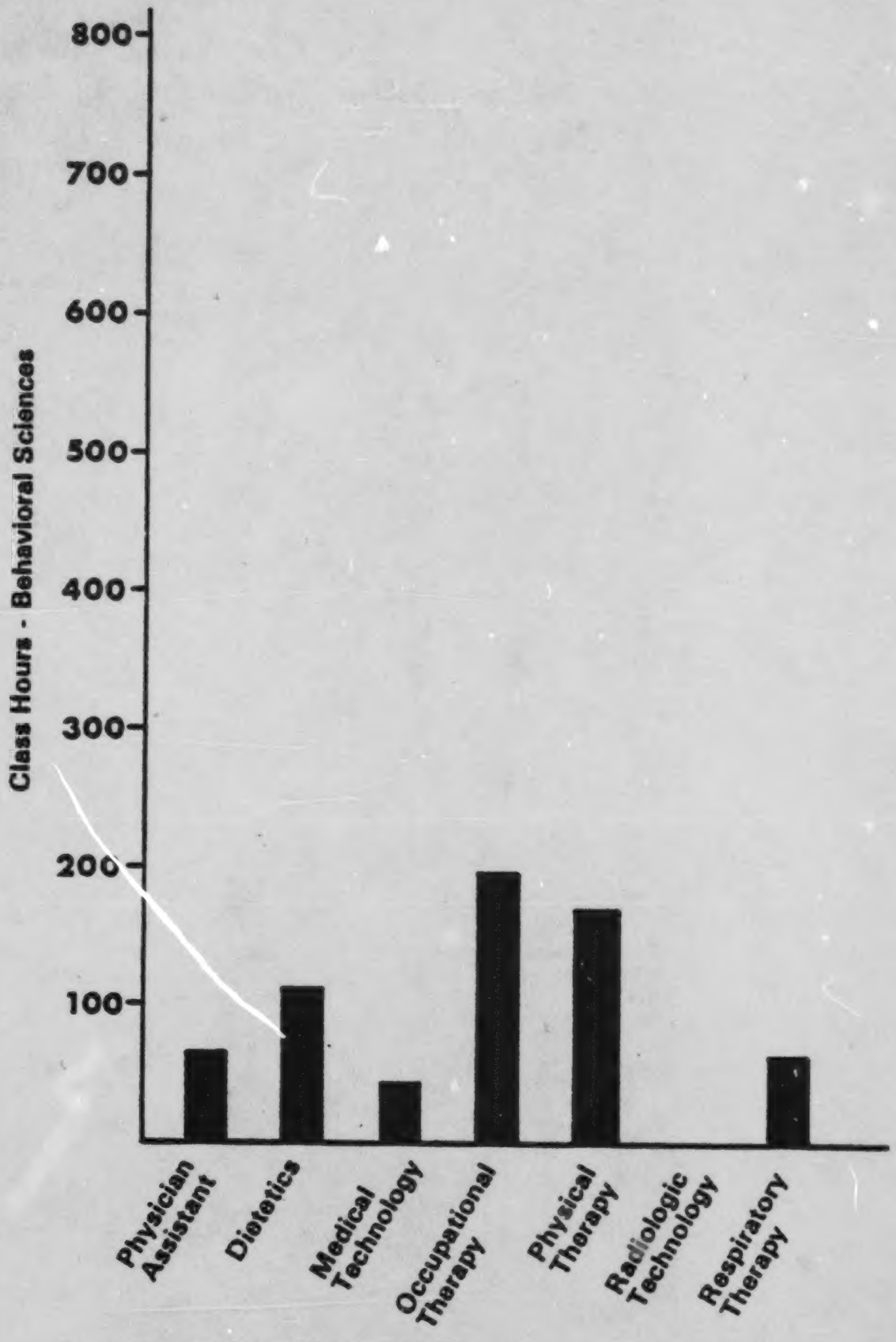


FIGURE 14 . Educational matrix of class hours in the Behavioral Sciences for six allied health professions and the physician assistant.

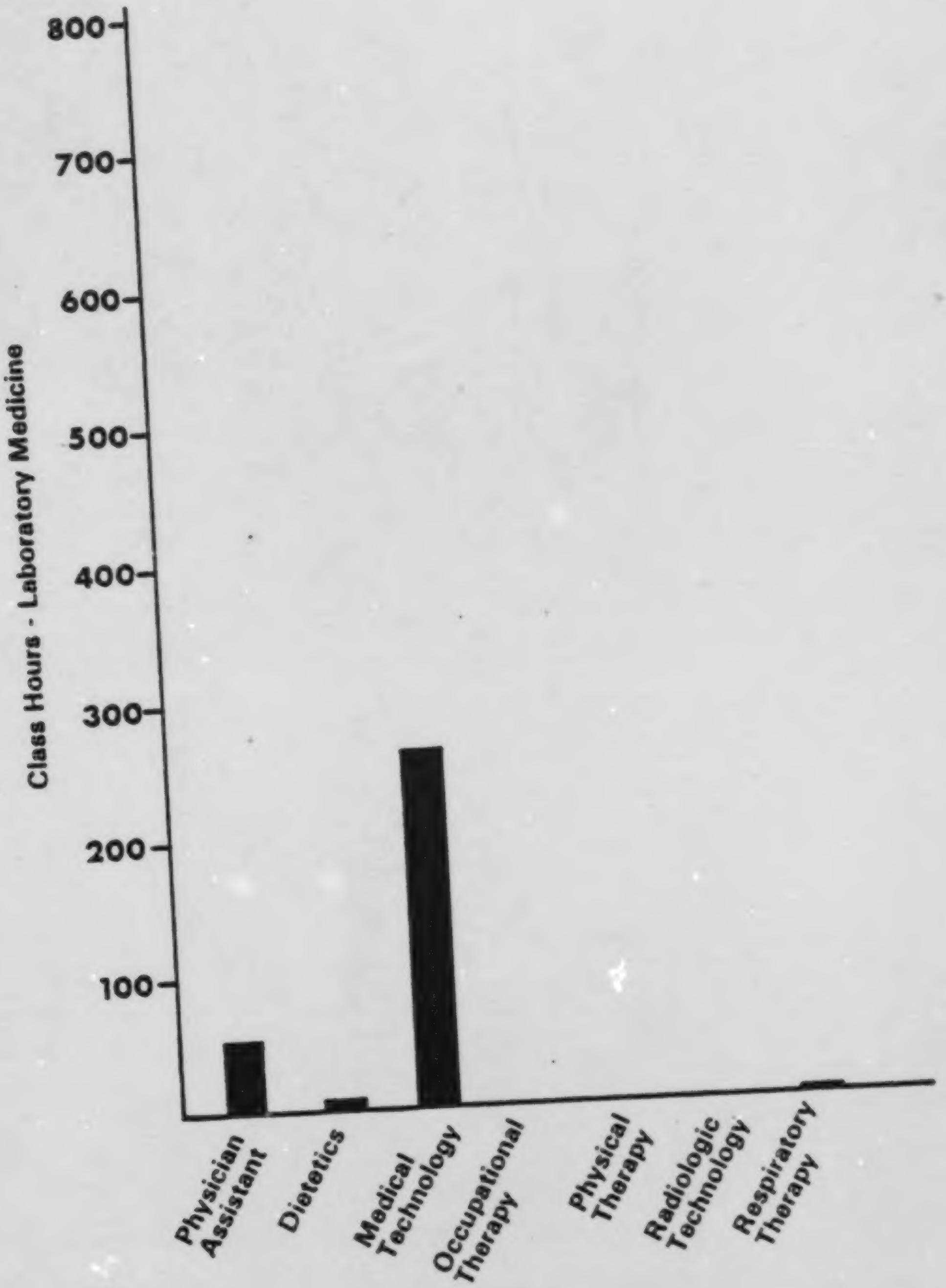


FIGURE 15 . Educational matrix of class hours in Laboratory Medicine for six allied health professions and the physician assistant.

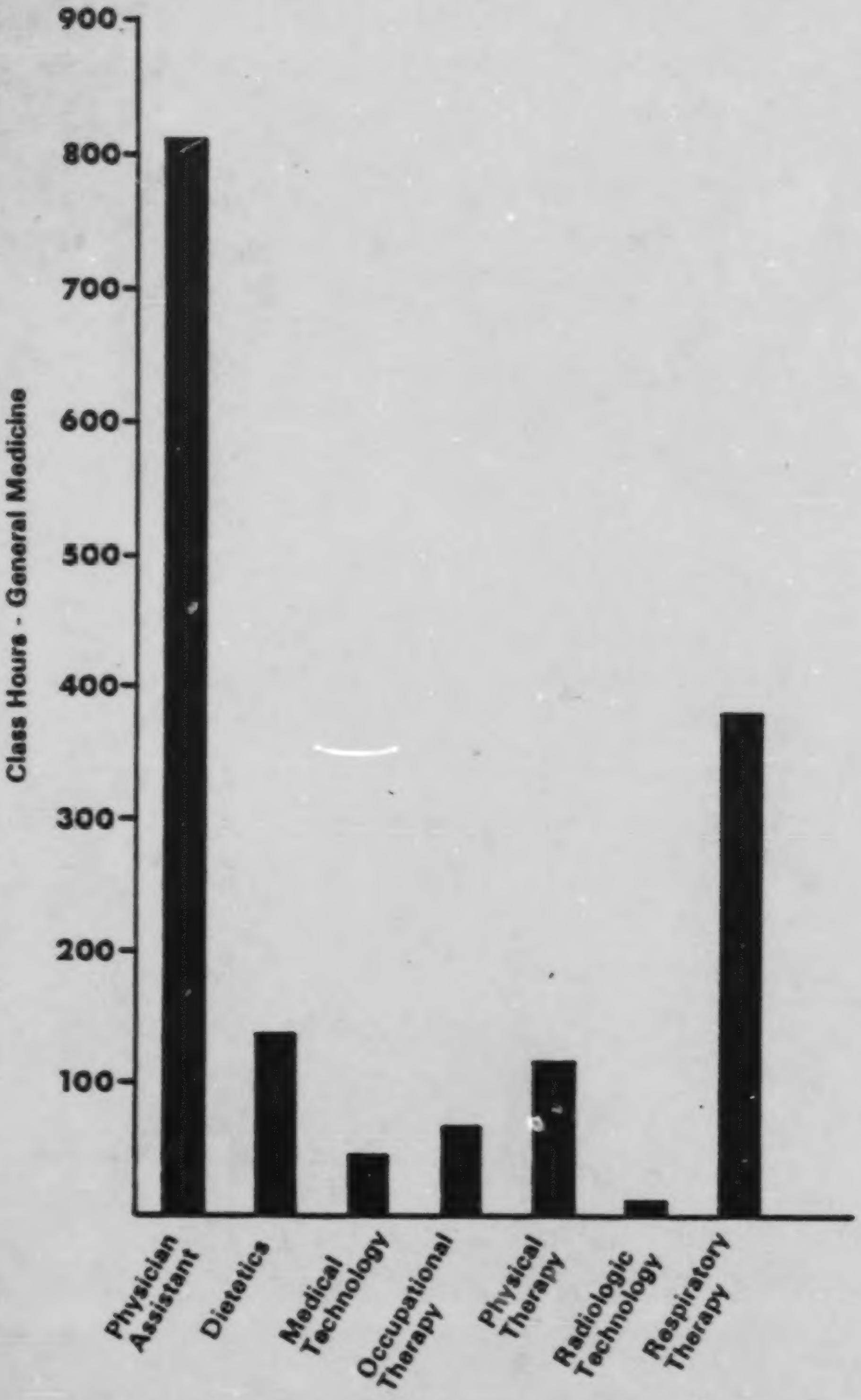


FIGURE 16 . Educational matrix of class hours in General Medicine for six allied health professions and the physician assistant.

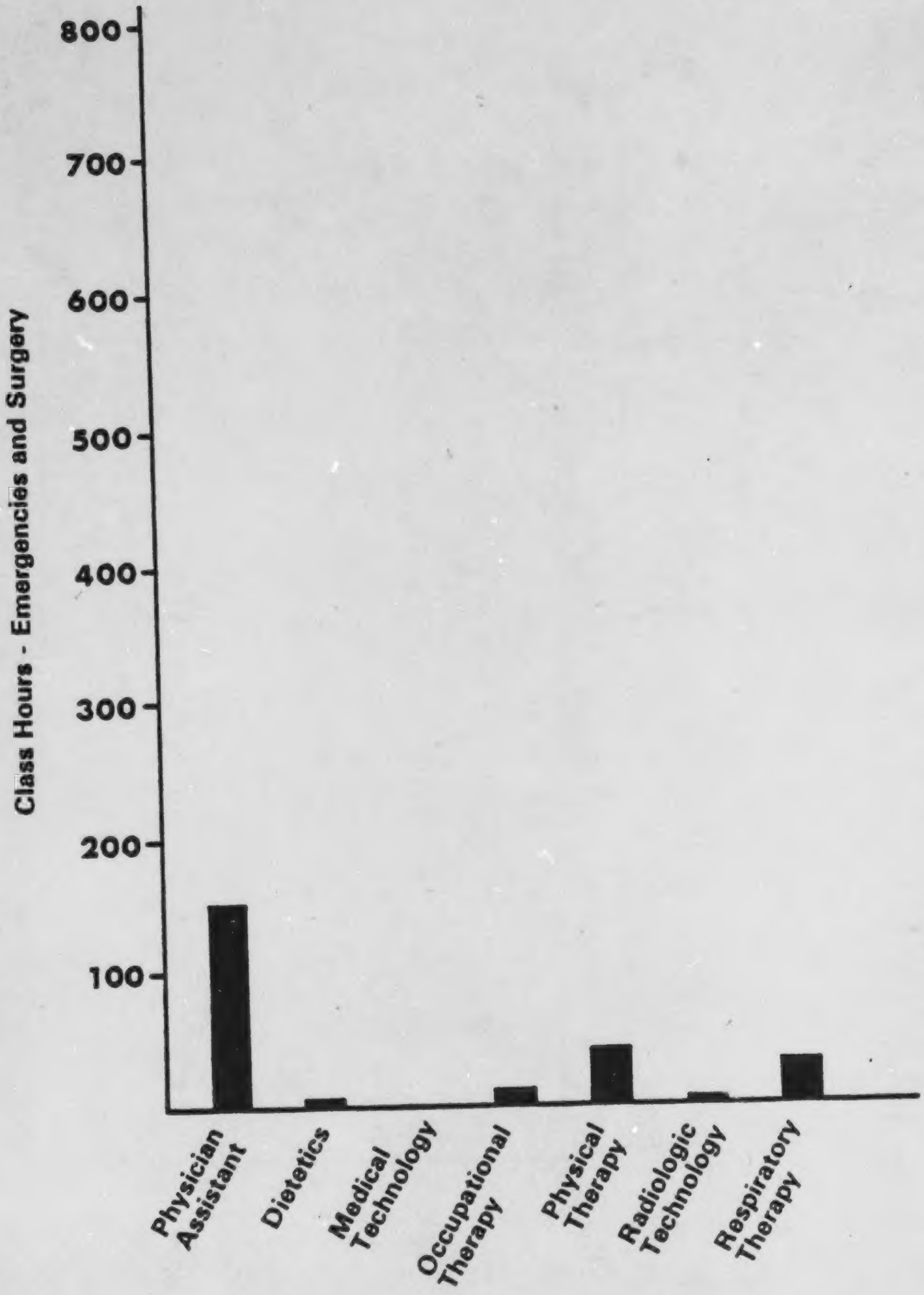


FIGURE 17. Educational matrix of class hours in Emergencies, Injuries, and Surgical Procedures for six allied health professions and the physician assistant.

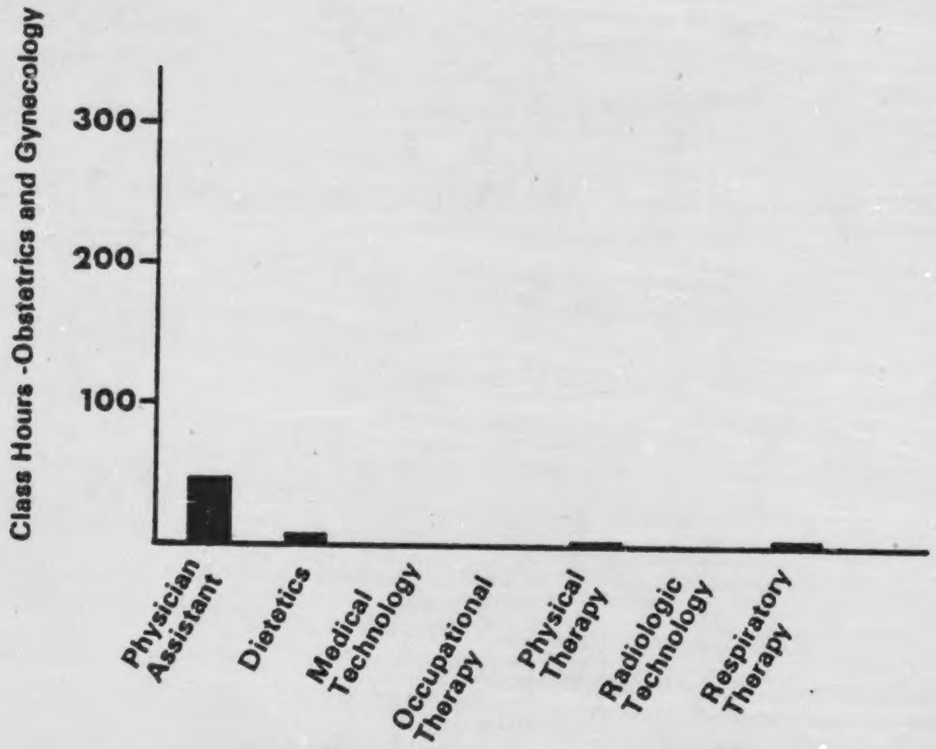


FIGURE 18 . Educational matrix of class hours in Obstetrics and Gynecology for six allied health professions and the physician assistant.

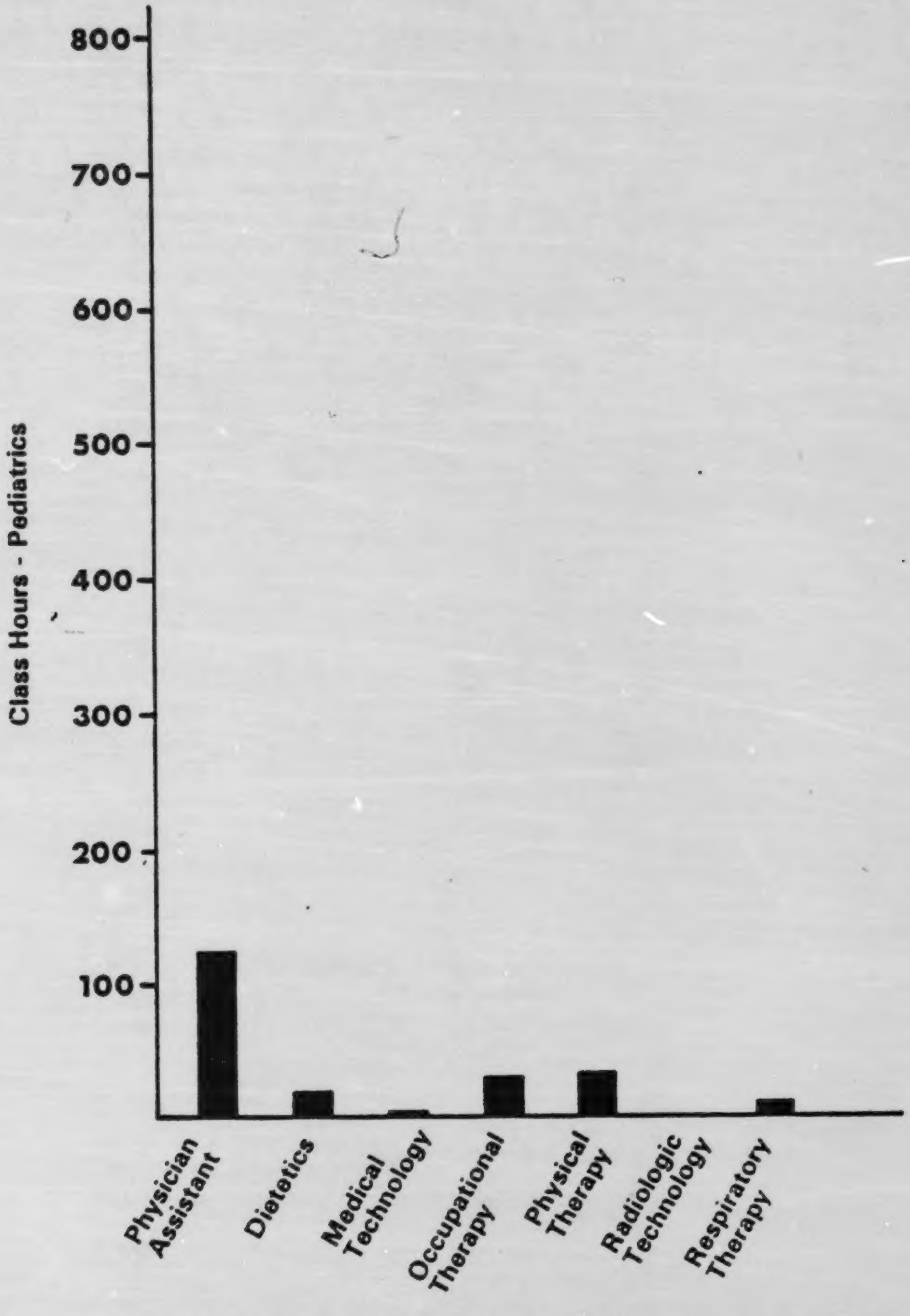


FIGURE 19 . Educational matrix of class hours in Pediatrics for six allied health professions and the physician assistant.

Chapter 4

TEST CONSTRUCTION, ADMINISTRATION, INTERPRETATION AND CURRICULAR PRESCRIPTION

The Item Library has been developed in such a manner that it is possible to construct examinations of varying length, difficulty, and content. This chapter describes in detail the procedures employed in the construction, administration, and scoring of the Profile Examinations. Furthermore, an example of curricular prescription is presented.

Because of the importance of the coding scheme used to store and retrieve items by content area, a description of MeSH is appropriate. Medical Subject Headings (MeSH) is the thesaurus which was developed by the National Library of Medicine for MEDLARS, a computer-based information retrieval system which generates Index Medicus as well as other medical bibliographies and provides for several on-line literature retrieval services of which the most widely used is MEDLINE.

MeSH was originally chosen as the indexing and searching vocabularly for the Item Library over other thesauri because it is more comprehensive and all-inclusive in providing terminology for the entire field of medicine and related disciplines. MeSH currently provides approximately 10,000 terms which provide for very broad subjects as well as very specific concepts. The principle on which the use of MeSH is based is that of coordinate indexing with which a number of terms or subject headings are used to index a concept completely. Therefore, retrieval of information from the computer data base is dependent upon combinations of terms to derive material of the desired specificity.

The MeSH code used in indexing and searching the item library is an alphanumeric code derived from Medical Subject Headings - Tree Structures in which all of the subject headings are arranged in a hierarchical manner providing for and showing relationships between broad and narrow terms.

Each test question was indexed with a maximum of 12 MeSH codes to provide for balance in test construction, at least one MeSH code for each question represents a very general subject area. To illustrate, each question was coded and is, therefore, retrievable with one of the following:

Internal Medicine	G2.403.776.409
Pediatrics	G2.403.776.671
Ob/Gyn	
Obstetrics	G2.403.776.671
Gynecology	G2.403.776.342
Surgery	G2.403.776.909
Basic Sciences	
Anatomy	G1.100
Biochemistry	G1.201
Genetics	G5.
Microbiology	G1.273.540
Pharmacology	G1.703
Physiology	G1.782

Additional codes are used to include the specific and important concepts of the question and correct answer. The multi-faceted indexing applied to each question before it enters the test item library makes possible the machine retrieval of questions which satisfy the format as outlined.

Because the Item Library was constantly growing in size, searching with codes which represent general concepts yielded a very large number of questions. To retrieve a more practical number of questions for construction of an exam, additional descriptors (MeSH Codes) were used. This was done by entering specific codes, e.g. A3.492 (Gastrointestinal System), or by entering the "explosion" symbol, G-, followed by a specific code, e.g. G-A3.492. In this example, use of the "explosion" symbol will retrieve all questions which are indexed with A3.492 (Gastrointestinal System) as well as any of the codes more specific that it in the hierarchy. These include codes for intestines, cecum, appendix, stomach, as well as several other concepts having codes beginning with A3.492 and which are indicated as being more specific than "Gastrointestinal System".

Search Examples

User Enters	Retrieval	Comment
G1.782 (Physiology)	900 questions	Additional MeSH codes are used to limit number
G1.782. AND G-A3 (Digestive)	17 questions	
G1.782. AND A3.492 (Gastrointestinal System)		Search is expanded by using G- to include more specific gastrointestinal concepts
G1.782 AND G-A3.492	9 questions	
G-C6 (Digestive System Diseases)	334 questions	Includes all questions on any aspect

User Enters	Retrieval	Comment
		of C6-pediatric, surgical, diagnostic, therapeutic
G-C6.405.748 (Stomach Diseases)	22 questions	
C6.405.748.369 (Gastritis)	7 questions	
G-6 AND G2.403.776.909	112 questions	G-C6 is narrowed to more specific disease codes listed under C6 for more limited number of questions
G-C6 AND G-E1 (Diagnosis)	50 questions	All questions relate to a digestive system disease and at least one of the diagnostic techniques in Category E1

Construction of a profile examination from the test item library required initially establishing the proportions of general subject areas desired. In the construction of PEPE examinations for field testing, curricular information from the matrix was utilized in establishing the format of the examinations. It was important that the questions represented the theoretical information base of the profession. By combining the data from the two programs analyzed, a representative examination was selected according to the following general formula:

		# items/400-item exam
Basic Sciences	30%	120
General Medicine	40%	160
Health Care & Preventive Medicine	5%	20
Surgical Procedures & Emergencies	10%	40
Pediatrics	8%	32
Obstetrics & Gynecology	3%	12
Behavioral Sciences	4%	16
TOTAL	100%	400

The computer search formulations for PEPE examinations required an additional MeSH code, N2.350.84, to retrieve only those questions which had been designated as appropriate for the physician extender.

To provide for balanced content within these general categories, test questions were chosen to cover more specific subjects. Within the Basic Sciences, a balance from the following was selected:

Anatomy
Biochemistry
Genetics
Microbiology
Pharmacology
Physiology

The following subject categories provided the basic parameters for selection of questions within Internal Medicine and Pediatrics, when appropriate:

Bacterial, Viral & Parasitic Diseases
Neoplasms
Musculoskeletal Diseases
Digestive System Diseases
Respiratory Diseases
Otorhinolaryngologic Diseases
Neurologic Diseases
Ocular Diseases
Urinary & Male Lymphatic Diseases
Neonatal Diseases & Abnormalities
Dermatologic Diseases
Nutritional & Metabolic Diseases
Endocrine Diseases
Immunologic Diseases
Injuries & Poisoning
General Pathology
Diagnostic Techniques
Behavioral Sciences
Environmental Health & Preventive Medicine

Questions included in the Obstetrics and Gynecology category were chosen primarily from:

Gynecologic & Obstetric Diseases
Reproductive & Female Urogenital Physiology
Pregnancy
Obstetric Surgery & Delivery
Gynecologic Surgery

To attain balance within the Surgery category, questions were chosen primarily from the following areas:

General Surgery
Minor Surgery, Wounds & Injuries
Neurosurgery
Cardiovascular Surgery
Digestive System Surgery
Endocrine Surgery
Thoracic Surgery
Urologic Surgery
Orthopedics
Anesthesiology

In generating an examination, a series of search formulations (combinations of MeSH codes) which represent the general and more specific concepts desired in the examination were entered in the computer. For a 400-item examination, 500 items were requested. Approximately 50 questions were initially eliminated from the 500 by "manual weeding". This process included, primarily, elimination of used questions with poor item analyses and questions which were too closely related in subject content. A first copy of the developing examination, the "dress rehearsal", consisted of approximately 450 items which was duplicated and circulated to members of the Test Committee. Following the intensive review of the "dress rehearsal" additional "weeding" and selection of the items occurred, based on comments of the Test Committee Members, to arrive at the final 400 questions which appeared on the examination. Concurrently with the Test Committee review, the Item Editor carefully examined each of the questions on the "dress rehearsal" for errors in spelling and wording, and the medical librarians updated older references, if necessary. Corrections to any of the items were made online at the terminal in preparation for the final computer listing of the 400-item examination.

Administration

The 400-item Profile Examinations were administered in two parts of 200 items each. Examination sessions were scheduled for 8 A.M. - 12 P.M. and 1 - 5 P.M.; however, where schedules of examinees required it, two four-hour sessions were scheduled for separate days. Four hours allocated for 200 items have proved to be ample time. The median completion time was about 2 hours.

Soft leaded pencils, answer sheets and instructions were distributed prior to admission of examinees to the testing room. Optical Scanning forms were prepared by the Optical Scanning Corporation for use with the Profile Examinations. The complex scoring programs required these special forms. In order to commence the examination, the following instructions were read.

1. Please write your name on the examination booklet. Write your name and the examination date on the front of the answer sheet (Part I).
2. Turn the answer sheet sideways and, using a soft lead pencil, mark the I.D. number box from left to right in the nine boxes provided with your social security number or another pre-arranged I.D. number. Complete the areas labeled 'CLSF' and'LOC.CODE' according to the codes on your instruction sheet.
3. Note: Question numbers run consecutively across the page.

4. Circle your answer choice on the examination, then mark with a pencil the proper space on the scoring sheet. All questions have only one correct answer. More than one mark per question will constitute a wrong answer.
5. Answers 1-200 are on the front of the answer sheet (Part I), answers 201-400 are on the back (Part II). Four hours will be allotted for each section.
6. Please do not make any stray marks on the answer sheet.
7. Break periods will be limited to fifteen minutes. All test materials are to be left with the proctor during breaks.
8. If you complete the section of the examination in less than the allotted time, please leave as quietly as possible.

Use of the seat number facilitated return of the answer sheets at the time of beginning the afternoon (Part II) session. Recording the examinee's name on the examination booklet facilitated the return of exam booklets to examinees at the conclusion of the day. The reader is reminded of the policy which encourages use of Profile Examinations as a learning tool. Return of the examination increases the likelihood of the student using the exam as a learning resource. It also minimized quarrels over suspected scoring errors, since the student had an opportunity to hand score the examination and match that score with the computer's score.

As the reader noted in the examination instructions, breaks of 15 minutes duration were allowed. Experience indicated that students require from 1 1/2 hours to the full 4 hours for completion of each examination part.

Appropriate modifications in the instructions and time allowed were made when 200-item Profile Examinations were used. When an abbreviated form is used, it is recommended that additional testing be conducted in content areas for which the results are inconclusive.

The basic form of reporting scores was designed to be the percent correct for each examination category. When appropriate the user may request, in addition to the percent correct scores, standard scores with a mean and standard deviation of 500 and 100, respectively. The scoring program was designed so that the standard scores could be computed using various combinations of the 'CLSF' code. The scoring program required a set of cards which designate the content category to which each item was assigned and an answer key in the form of a completed optical scan answer form. A special feature of the scoring program was provision for a key validation which makes it possible to remove statistically unreliable items from scores.

Interpretation and Curricular Prescription

Interpretation of Profile Examination results is fairly straightforward. The specifications of content by which the examination was generated serve as an outline for interpretation. The content was specified before the test was generated, thus the scores indicate the level of cognitive information with regard to that content. As stated earlier, Profile Examination scores were reported in units of percent correct and as standard scores with a mean and standard deviation of 500 and 100, respectively. The standard scores were based on the examinee group at hand, since each Profile Examination is usually a unique set of questions.

The Profile Examination should be considered an examination and learning system, rather than being viewed simply as a test of facts. Because it is a flexible system of examination construction, tests may be developed suitable to a specific curriculum. This capability is desirable, since considerable variation exists among programs. Furthermore, this flexibility permits faculty of individual programs to set their own standards of performance.

Setting standards of performance might be accomplished by any one of several methods (Millman, 1973). The item analysis data obtained during field testing should be useful for item selection during test construction, as well as setting performance standards. Setting standards of performance is generally best accomplished by either the faculty or professional organization responsible for grading or certifying the individuals for whom the standards are intended.

In the following example of score interpretation and curricular prescription, the mean performance of physician assistant students at the end of their didactic program was used as the standard of performance toward which a beginning student should work. Since the student in the following example had educational and clinical experiences in health care, it was assumed that some content areas of factual information were sufficiently strong that the didactic program may be shortened by eliminating the curricular blocks related to areas of strength. In the following example, the results of PEPE 2 were considered.

Scores on PEPE 2 of a student at entry of a physician assistant program are presented below along with the expected score following a year's didactic program.

Content Category	Student Score	Post-Didactic Mean	Strength Weakness
Gen Med	44.4	44.0	+
Peds	40.4	40.2	+
Ob/Gyn	31.2	40.8	-
Basic Sci	34.6	49.0	-
Physiology	46.2	51.7	-
Biochem	19.2	50.3	-
Anatomy	32.1	43.8	-
Pharm	35.5	50.7	-
Micro	40.0	48.6	+
Genetics	14.3	36.3	+
Infect Dis	55.9	53.4	+
Neoplasms	37.5	40.9	-
Musculoske	16.7	45.2	-
Digestive	56.3	34.8	+
Urogenital	44.4	48.2	-
Respiratory	28.6	33.7	-
Endocrine	23.5	36.5	-
CV	47.1	43.7	+
Hemic	50.0	43.3	+
Nut & Metb	33.3	45.3	-
Inj,Poi,Im	21.4	32.1	-
Gen Path	35.7	41.4	-
Techniques	48.3	47.9	+
Neurology	33.3	51.9	-
Radiology	60.0	33.6	+
Behav Sci	30.0	41.1	-
Total	38.0		

The pattern of scores for this student indicate strengths in the areas of General Medicine and Pediatrics beyond that demonstrated by the average person completing the year of physician assistant curriculum; therefore, these curricular blocks could be altered by appropriate faculty review. Matriculation could be shortened to the extent indicated by the review. On the other hand, this student does not have sufficient strength in the Basic Sciences and Obstetrics/Gynecology to omit those curricular blocks. Further analysis indicates that this student specifically needs exposure to Biochemistry, Anatomy, and Pharmacology curricular elements; information is sufficiently strong in Physiology and Microbiology to consider an alternate approach to these elements of curriculum.

Additionally, further information in the minor areas of Neoplasms, Musculoskeletal, Urogenital, Respiratory, Endocrine, Nutrition, Injury, Poisoning, and Immunology, General Pathology, Neurology, and Behavioral Science is needed. Thus, the curriculum of this student should be tailored to cover the aforementioned areas.

Reference to the curricular matrix for the physician assistant program at Sheppard Air Force Base indicates that the following curricular prescription could be made. (Based on the calculation of class hours as defined in curricular analyses page 14).

Content Area	Class Hours
Gynecology and Obstetrics	39.8
Gynecologic Diseases	
Normal Pregnancy and Delivery	
Pregnancy Complications	
Anatomy and Physiology	382.2
Integumentary System	
Musculoskeletal System and Body Regions	
Digestive System	
Respiratory System	
Cardiovascular System	
Endocrine and Reproductive Systems	
Excretory System	
Nervous System	
Microanatomy	
The Cell	
Tissues	
Developmental Anatomy-Embryology	
Neoplasms	7.5
Musculoskeletal Diseases	24.5
Bone Diseases	
Joint Diseases	
Muscular Diseases	
Myography	
Urologic Diseases	45.5
Kidney Diseases	
Urinary Calculi	
Urinary Tract Infections	
Respiratory Diseases	53.2
Lung Diseases	
Pleural Diseases	
Respiratory Disorders	
Respiratory Hypersensitivity	
Respiratory Tract Infections	
Respiratory Therapy	
Endocrine Diseases	34.5
Adrenal Gland	
Diabetes Mellitus	
Parathyroid Diseases	
Pituitary Diseases	
Thyroid Diseases	

Nutritional and Metabolic Diseases	9.5
Emergencies, Injuries and Poisoning	38.4
Poisoning	
Wounds and Injuries	
Emergencies and Treatment	
Immunology	25.6
Basic Immunology	
Clinical Immunology	
General Pathology	20.8
Pathologic Processes	
Collagen Diseases	
Neurologic Diseases	33.5
Behavioral Sciences	130.6
Behavior and Behavior Mechanisms	
Psychologic Processes	
Behavioral and Mental Disorders	
Psychiatric Tests and Therapy	

This hypothetical example (based on an exceptionally high student score) indicates a total of 845.6 hours of curricular content compared to 2275 hours in the standard curriculum. Prescription of curricular elements on the basis of individual need, rather than having standard curricular requirements, affords the opportunity of realizing substantial savings in time required for completion of the program. If time is not important then the curriculum can be more appropriately tailored to individual need in other areas. It should be emphasized that faculty involvement is essential for analysis and implementation within any given program.

REFERENCE

Millman, J. Passing scores and test lengths for domain-referenced measures. *Review of Educational Research*, 1973, 43, 205-216.

Chapter 5

TEST ANALYSIS

This chapter on test analysis reports the results of seventeen examinations generated by the system over a three year period. Many of the reliability and validity studies reported were based on data collected by administration of the Profile Examinations to medical students, for reasons cited earlier. The range of education of these examinees was quite broad, from students just out of high school to those completing their six-year medical program. Thus, the additional participants, physician assistants and allied health professionals were within the score range of examinees used in the reliability and validity studies based on tests of medical students. Studies based specifically on the physician assistant were also reported. This chapter concludes with a section on the field testing conducted with allied health professionals.

Reliability

This section is concerned with the reliability of the computer-generated tests as a measurement device. Assessment of reliability has been an ongoing part of the project in which varied approaches were used. Determining the reliability of a test is analogous to assessing its degree of precision. The more reliable a test is, the more precise its measurements are. A highly reliable examination is analogous to a yardstick that does not bend, stretch or otherwise fluctuate in a manner to cause measurement error.

Another means of interpreting the meaning of reliability follows. It is often assumed in educational settings that there exist individual differences in the amount of information learned among students. Suppose that an examination is given to assess these individual differences and the scores do, indeed, vary. Three explanations of the observed differences for individual scores are plausible; 1) the differences are due to real differences in the amount of information learned; 2) the differences are due to errors in measurement, and; 3) the differences are due to a combination of real differences and measurement error. Explanation (1) is too optimistic in that it assumes that the examiner has been infallible in constructing the examination and that testing conditions were ideal. On the other hand, explanation (2) may be too extreme for it assumes that all students would achieve the same identical score were it not for random fluctuations caused by the poorly constructed examination. Common sense would lead one to assume that explanation (3) appears more plausible than either of the other two explanations. The assessment of reliability is a method for determining the proportional contribution real differences and measurement error can make in explaining observed individual differences in examination scores. The reliability coefficient explains what part of the observed score variance is true variance and what part is error variance. From the reliability data it is possible to make estimates of the 1) range of expected fluctuation of scores for repeated testing and 2) probably true score for a given individual score.

Various approaches were used to assess the reliability of Profile Examinations. Each method serves a different purpose, adding information about the examinations' reliability. In order to obtain large samples on a regular basis for field testing purposes, Profile Examinations were given students at the University of Missouri-Kansas City School of Medicine. The 400-item examinations covering the five major areas of Internal Medicine, Pediatrics, Obstetrics-Gynecology, Surgery, and Basic Sciences were given to approximately 350 participants every three months. Thus, an ongoing test of the computer system's ability to generate reliable examinations was available.

The internal consistency method of assessing reliability is generally considered to yield data pertinent to the adequacy of content sampling. It is assumed that an examination which adequately samples the domain of content will have a high coefficient of internal consistency. Since reliability may be interpreted as an indication of sampling adequacy, it is logical that a relationship exists between test length (size of sample) and reliability (adequacy of sample). Generally, lengthening a test increases its reliability. It is important that the reader remember this point in considering the following reliability data, because substantial variability in the magnitude of reliability coefficients will be observed.

Computer programming was provided so that Kuder-Richardson, formula 20 coefficients of reliability were computed each time an examination was scored. Thus, the system provided a continual assessment of the reliability of examinations it generated. The reliability and number of items per category for the August and December, 1974 and February and May, 1975 Profile Examinations are presented in Appendix D. The reliability of the August and December, 1975 and Febraury and June, 1976 Profile Examinations is presented in Appendix D. The reliability and number of items per category for the August and November, 1976 and February and May, 1977 Profile Examinations are presented in Appendix D.

The frequency table presented on the following page in Table 1 summarized the reliability data previously reported in Appendix D. The reliability coefficients of category and Total scores for the November, 1974 through May, 1977 Profile Examinations were considered in compiling the frequency distribution of reliability coefficients by category.

Table 1

Frequency Distribution of Reliability Coefficients

of Twelve Profile Examinations, August, 1974 - May, 1977

	Below .500	.500-.599	.600-.699	.700-.799	.800-.849	.850-.899	.900-.949	.950-.999
Int Med					•••	•••• ••	••	•
Peds			•	••••	••••	•••		
Ob/Gyn		•		••••	•••	••••		
Surgery			•	•••• ••	•••	••		
Basic Sci						•••• ••••	•••	•
Physiol	•	•••• ••	••	••		•		
Biochem		••	•••• ••	••	•	•		
Anatomy	•••	•	••••	•••			•	
Pharm			••	•••• ••	•••		•	
Micro	• •	••	•••• ••	•		•		
Genetics	•							
Infect Disease		•••	•••••	•••	•			
Neoplasms		•	••••	•••• ••	•			
Musculoskel	•••• •••	•						
Digestive	••	••••	••••	••				
Urogenital	••••	•••	••					
Respiratory	••••	•	••••	•••				
Endocrine	•••• •	•••	••	•	•			
Cardiovascular	•••	•••• •	•••	•				
Hemic	•••• •	••	•••	••				
Nerv. System	•••	••	•					
Skin Dis	•			•				
Nut & Met	••••	•	•••• •			•		
Inj, Poi, Im	••••	•••	•••	•	•		•	
Neonatal	••••	•••	•	•				
Gen Path	••	••	•••• •	•••		•		
Techniques		•	•••• •••	••••				
Neurology	••		••					
Radiology	•••							
Behav Sci	•••• •••	•						
Health Care	•							
Lib Sci	•							
Total								•••••• ••••••

The data of Table 1 indicate that all Profile Examinations considered had reliability coefficients above .950, indicating that the total score is quite reliable. Next, consider the data pertaining to the five major categories of Internal Medicine, Pediatrics, Obstetrics/Gynecology, Surgery, and Basic Science. The reliability coefficients for the Internal Medicine category most frequently fell in the range of .850-.899; less than that observed for the Total score, but still quite respectable. The distribution of Pediatrics coefficients falls somewhat below that of Internal Medicine and demonstrates a wider range in magnitude. Data of previous tables indicate that the higher Pediatrics reliability coefficients have occurred in recent examinations; in other words, the reliability of the Pediatrics category has been improving during the past year. The pattern of the Obstetrics-Gynecology reliability coefficients is similar to that of the Pediatrics category, but with one observed reliability lower in magnitude than any observed for Pediatrics. The range of .850-.899 represents the modal frequency of reliability coefficients for the Obstetrics-Gynecology category. The range of .700-.799 represents the modal frequency of reliability coefficients for the Surgery category. The Surgery category generally is the least reliable of the five major categories; however, recent examinations demonstrated improved reliability of Surgery. Considering all twelve exams, the Basic Science category appears to be the most reliable of the five major categories, with all coefficients being above .850 in magnitude. The positive relationship between test length and reliability most likely accounts for this consistently high level of reliability noted with the Basic Science category and may account for the variation in reliability of the Surgery category. The other categories represented in Table 1 are minor categories in that they are subsets of the five major categories. At this point it is useful to consider the relationship of reliability and the standard error of measurement (SEM), which yields an estimate of the degree of score fluctuation anticipated due to measurement error. The more reliable test will yield less fluctuation of an individual's score over repeated testing. The analogy is that a perfect yardstick should yield the same measurement when repeatedly measuring the same distance. A less reliable yardstick will yield measurements fluctuating in value due to inherent error. The formula for determining the SEM is as follows: $SEM = SD\sqrt{1 - r}$; where SD is the standard deviation of test scores, and r is the reliability of the test. Consider a reliability of .950, for example; its SEM equals $100\sqrt{1 - .95}$ or 22.4 when the Population Standard Score is used. The SD is set at 100 by definition. Therefore, the POP STND Score is expected to fluctuate ± 22.4 about the individual's true score. When one recalls that the POP SND Scores range from about 150 to 950, the ± 22.4 figure does not appear large. These remarks are consistent with the observation that the precision of measurement increases or decreases as a function of the square root of reliability. The lower reliability will yield a larger range of expected score fluctuation produced by error. Considering the reliability coefficients of the minor categories, two related conclusions were made: 1) the reliability of a given category is quite variable across time, and 2) the lower number of items in a category yields lower reliability. Noting the variable reliability of the minor categories, special consideration in the interpretation of these scores is recommended. The scores of the Total and five major categories were consistently reliable. Users are recommended to use the terminal self-assessment procedure or the data of several examinations in order to achieve a larger number of items in the minor categories. For example, a student might draw 75 questions on Physiology via the terminal for self-assessment. Or, the Physiology scores across four examinations might be considered.

To summarize the internal consistency data, the Total score has always been observed to be reliable enough to distinguish between individual examinees. The reliability of the five major categories has been high enough to compare performance of groups and, in many cases, reliable enough to compare individual performances. The nature of the flagging process used at the University of Missouri-Kansas City is such that two students are not compared with one another, but against a standard set by the group performance of students one year below their level in medical school.

Analysis of the reliability of the Profile Examination category and total scores employed measures of internal consistency, Kuder-Richardson formula 20 and split-half reliability. Considering the nature of the Profile Examination system of evaluation, reliability assessed by an internal consistency approach for each exam is of primary importance; however, it is also of interest to assess reliability across time. Correlating the scores from two different Profile Examinations will yield a reliability coefficient sensitive to content and time sampling as sources of measurement error.

The scores of the November '74 Profile Examination were correlated with scores of the February '75 Profile Examination in order to assess reliability across time. Data in Table 2 indicate the reliability across time and the reliabilities within each test for categories of the November, 1974 and February, 1975 Profile Examinations. The reliability coefficients indicate there to be little measurement error introduced as a function of time. Another general observation to be made is that categories with low internal consistency (KR_{20}) tend to be less stable across time.

The final report of reliability is based on data collected during field testing of 24 physician assistant students. A

Table 2

RELIABILITY OF PROFILE EXAMINATIONS

	RELIABILITY ACROSS TIME	NOV '74 KR_{20}	FEB '75 KR_{20}
Internal Medicine	.845	.948	.890
Pediatrics	.645	.652	.774
Ob/Gyn	.664	.566	.868
Surgery	.689	.710	.676
Basic Science	.851	.913	.885
Physiology	.599	.700	.596
Biochemistry	.722	.840	.706
Pharmacology	.768	.804	.791
Microbiology	.332	.387	.524
Infectious Diseases	.665	.679	.742
Neoplasms	.641	.752	.691
Digestive	.332	.387	.524
Urogenital	.479	.508	.506
Pulmonary	.663	.750	.662
Endocrinology	.469	.724	.405
Cardiovascular	.444	.711	.494
Hemic	.601	.696	.556
Inj, Poi, & Im	.317	.570	.430
Pathology	.423	.350	.622
Techniques	.689	.776	.645

400-item Profile Examination was generated as a posttest of physician assistant students who had completed a year of instruction at Sheppard Air Force Base. Score results are presented later in this chapter. The number of items and reliability per category are presented in Table 3.

To a large extent, differences in reliabilities observed on this examination compared with ones previously reported can be accounted for by differences in number of examinees and the number of items per category. The total score reliability, .946, compares quite well with previously reported total score reliabilities. Likewise, the reliability of Medicine, Basic Sciences, Physiology, Biochemistry, Anatomy, Microbiology, Infectious Diseases, Digestive, Cardiovascular, Hemic, Injury, Techniques, and Behavioral Sciences are similar to those noted in previously reported examinations. The reliability of Pediatrics, Obstetrics-Gynecology, Pharmacology, Neoplasms, Musculoskeletal, Endocrinology, Nutrition, and Pathology are substantially lower than the reliabilities previously reported.

Considering the reliability data, one can conclude that the computer-assisted test construction system has produced many reliable examinations. The well known relationship between test length and reliability was substantiated repeatedly.

Table 3

THE NUMBER OF ITEMS AND RELIABILITY PER CATEGORY FOR A PROFILE EXAMINATION GIVEN TO GRADUATING PHYSICIAN ASSISTANT STUDENTS

Category	Number of Items	Reliability*
Medicine	146	.892
Pediatrics	45	.542
Obstetrics/Gynecology	31	.427
Basic Sciences	145	.874
Physiology	32	.603
Biochemistry	29	.759
Anatomy	27	.536
Pharmacology	26	.278
Microbiology	29	.550
Infectious Diseases	28	.470
Neoplasms	15	.159
Musculoskeletal	11	.014
Digestive	20	.711
Respiratory	18	.421
Endocrinology	13	.274
Cardiovascular	20	.601
Hemic	12	.504
Nutrition	13	.220
Injury	28	.609
Pathology	18	.383
Techniques	19	.530
Behavioral Science	14	.590
Total	400	.946

* KR-20 Computational Method

The lengthier categories tended to have higher reliabilities than did the small categories. This observation should be considered in generation and interpretation of Profile Examinations. Furthermore, the system's scoring programs allow for assessment of reliability by the Kuder-Richardson formula 20 method for each occasion of use. Since the system lends itself to construction of criterion referenced tests, the user should consider additional methods of assessing reliability, for example, Lovett's (1977) analysis of variance method for assessing reliability of criterion-referenced tests.

Validity

The preceding discussion indicates that the computer-generated examinations have desirable properties of reliability. Validity should now be considered. While reliability studies tell us of an instrument's precision, validity studies help us understand what is being measured. Validity indicates the degree to which a test measures what it was proposed to measure.

The nature and function of the Profile Examination is similar to that of an achievement test; therefore, content validity is an appropriate type of validity to consider. Since statistical procedures are difficult to apply to the assessment of content validity, the following points lead to a logical assumption of content validity:

1. Curricular objectives were specified in detail and coded for content with the MeSH code.
2. Questions of factual information were written and coded for content with the same MeSH code.
3. Each examination was generated according to specifications of content area using the MeSH code to retrieve questions from the item library.

As the item library grew in number of questions stored, examinations were generated with increased specificity of item content. Questions representative of each curriculum objective pertaining to factual information were generated.

Although it is important to consider content validity of an achievement test, correlations with external criteria also yield significant information. In the Fall of 1975, the course grades of University of Missouri-Kansas City medical students were compiled for various Arts and Sciences courses. Courses completed through spring semester of 1976 were included. This voluminous data offered several possibilities for analysis. Some limitations had to be imposed in order to restrict the scope of analysis to a point where feasibility and interest interact favorably. In order to expand the interest or significance, Profile Examination scores were included in the study. Thus, the present study sought an answer to the following questions:

1) What is the pattern and degree of interrelationship among science course grades?
2) What is the relationship of science course grades to topic-related profile examination scores?

The data of this study represented the performance of students who were at the Year 3 and 4 levels during the 1974-1975 academic year. Two sources of data were considered: course grades in the sciences and May, 1975 Profile Examination scores. Course grades were converted to a numerical scale using the conventional conversion where an "A" equals 4.0, "B" equals 3.0, etc. Population standard scores based on a mean of 500 and standard deviation of 100 from the Profile Examination were used.

The first analysis determined the interrelationship of course grades in the sciences. Figure 20, presented below, displays the relationships among course grades. A "-" indicates the position in the matrix where courses are correlated with themselves, a meaningless computation. A "+" indicates that the computed correlation coefficient between the two variables at hand was statistically significant ($p < .05$). The computed values of the correlation coefficient, statistical probability, and number of observations are presented in Appendix D.

		COURSE								
		GEN-CHEM	CHEMTWO	ORGCHEM	BIOCHEM	PHYSIO	MICRO	GENETICS	BOTANY	ZOOL
	GEN-CHEM	-	+	+	+	+		+		+
	CHEMTWO	+	-	+	+				+	+
	ORGCHEM	+	+	-	+	+		+	+	+
COURSE	BIOCHEM	+	+	+	-	+		+	+	
	PHYSIO	+		+	+	-			+	+
	MICRO						-			
	GENETICS	+	+	+				-		
	BOTANY		+	+	+	+			-	+
	ZOOL	+	+	+		+			+	-

Figure 20. The Interrelationship of Science Grades

The data represented by Figure 20 indicate a high degree of relationship among science grades. For example, the grades achieved in General Chemistry correlate with all other science grades with the exception of Microbiology and Botany. The grades achieved in Organic Chemistry correlate significantly with all other science grades except for those of Microbiology. On the other hand, the grades of Microbiology do not correlate significantly with the grades of any other science course. Obviously, the interpretation of these results is open to many possibilities; however, this author would raise a couple of questions for further consideration. Why are grades achieved in Microbiology apparently unrelated to grades achieved in other science courses? Is the mastery of content of General Chemistry so important that it influences the level of performance in other science courses?

Having determined the relationship among science course grades, the next step of this study was to analyze the relationship of course grades with Profile Examination scores. The reader should note that use of the May, 1975 Profile Examination scores in this analysis results in a situation wherein grades in courses taken at variable time periods prior to the date of the Profile Examination were used. Figure 21 indicates the correlation of course grades with various Profile Examination scores. Again, a statistically significant ($p < .05$) correlation between two variables is indicated by a "+" sign. The "-" entry represents the meaningless correlation of a variable with itself. The computed values of the correlation coefficient, statistical probability, and number of observations are presented in Appendix D.

Considering the high degree of interrelationship among science course grades, it should be no surprise that the grades of General Chemistry, Chemistry Two, Organic Chemistry, Biochemistry and Physiology, all correlate significantly with the Profile Examinations scores in Basic Science, Physiology, Biochemistry, Anatomy, Microbiology and Total. Similar to the findings of the course grade analysis, the current analysis indicated that grades in Microbiology did not correlate with any of the Profile Examination categories presently considered.

		Profile Examination Category					
		BASICSCI	PHYSIO	BIOCHEM	ANATOMY	MICRO	TOTAL
COURSE	GEN CHEM	+	+	+	+	+	+
	CHEMTWO	+	+	+	+	+	+
	ORGCHEM	+	+	+	+	+	+
	BIOCHEM	+	+	+	+	+	+
	PHYSIO	+	+	+	+	+	+
	MICRO						
	GENETICS	+	+	+			
	BOTANY	+	+	+		+	+
	ZOOL		+				+

Figure 21. The Correlation of Course Grades with Profile Examination Scores

In general, this analysis indicated that students who master the content of science courses perform well on related Profile Examination categories, even though the Profile Examination was administered at variable time periods following the course. Although the Profile Examination used questions from multiple sources in a content sampling approach to test construction, Profile Examination scores correlate with achievement in the science courses.

In conclusion, the results of this study may be summarized as follows:

1) With the exception of Microbiology, grades in science courses are significantly interrelated;
2) In general, the course grades in sciences are correlated with topic-related Profile Examination scores. Again, the notable exception was Microbiology.

Each Fall semester Year 2 students at UMKC are assigned to either Pediatrics or Obstetrics-Gynecology. Approximately half the Year 2 class is assigned to each rotation. The Spring semester assignments are then reversed. At the time of the December, 1974 Profile Examination the Year 2 students were nearing the end of their Pediatrics and Obstetrics-Gynecology experiences. This situation lends itself well to a study of construct validity of the Profile Examination.

The logic of this study is as follows. It is assumed that during the Fall semester, students assigned to Obstetrics-Gynecology acquired more information related to Obstetrics-Gynecology; furthermore, students assigned to Pediatrics acquired more information related to Pediatrics than to Obstetrics-Gynecology. Therefore, Pediatrics students should score higher than Obstetrics-Gynecology students on the Pediatrics and Neonatal categories of the December, 1974 Profile Examination. Additionally, the total score on the Profile Examinations should not differ for the two groups.

Student _t_ - tests were computed between the Obstetrics-Gynecology and Pediatrics groups in order to test the hypotheses stated above. Table 4 presents the results of data analysis. Note that in all four cases the data confirmed expectations.

Table 4

COMPARISON OF OBSTETRICS-GYNECOLOGY AND PEDIATRICS GROUP MEANS ON THE DECEMBER '74 PROFILE EXAMINATION

	Examination Category			
Group	Ob/Gyn	Pediatrics	Neonatal	Total
Ob/Gyn	43.6	41.6	34.4	39.0
Pediatrics	36.9	46.5	42.2	39.7
t-ratio	2.69*	-2.40*	-2.30*	- .5

$^*p < .01$

In reference to the Pediatrics group, students assigned to Obstetrics-Gynecology scored 6.7 points higher, 4.9 points lower, and 7.8 points lower in the Obstetrics-Gynecology, Pediatrics, and Neonatal Profile Examination categories, respectively. All three differences reported were statistically significant ($p < .01$). The difference in mean total score, .7 points, was not statistically significant. The final step in this analysis was to determine if the observed differences in the scores of the two groups existed prior to their Fall semester assignments. Analysis of August, 1974 Profile Examination scores indicated no significant differences between the two groups at the time they began their Fall assignments.

This analysis was interpreted as support for the contention that the Obstetrics-Gynecology, Pediatrics, and Neonatal Profile Examination categories measure information base in the areas indicated by their respective content labels. It is also possible to interpret these findings to indicate that curricular experiences of these Year 2 students did produce increments of knowledge in the areas of focus.

The correlation of Profile Examination and National Board of Medical Examiners (NBME) scores has been studied as a means of determining validity of the Profile Examinations and was previously reported (Willoughby, Dimond, and Smull, 1977). That the Profile Examination scores correlate with the well established NBME is an indication that the Profile Examination measures factual information important in medical education. Having established that the correlation was significant, a regression equation was developed which uses the Profile Examination total scores of two consecutive examinations to predict NBME, Part I, performance. The accuracy of these predictions was quite good. Subsequent discussion will describe an analysis of Profile Examination and NBME results for the students who took NBME, Part I, at the June, 1976 administration.

A Pearson product-moment correlation was computed for each NBME category and its Profile Examination counterpart for scores of June, 1976. The correlation coefficients and their squared values are presented in Table 5.

All the correlation coefficients presented below are statistically significant ($df = 38$; $p < .01$), indicating that the observed relationship is not due to chance sampling factors. Generally, one can conclude from the data that students who performed well on the Profile Examination also performed well on the NBME and, conversely, that low performing students will likely score low on the NBME. This degree of relationship would indicate that both the Profile Examination and NBME are measuring something in common. Yet another means of interpreting the data exists. Squaring the obtained correlation coefficient yields r^2 which is an indication of the degree of overlap between two variables expressed in terms of proportion of score variability. For example, the r^2 associated with the Total score indicates that 82% of NBME score variability can be predicted in this sample by knowing the Profile Examination Total score. The data indicated that the relationship between Profile Examination and NBME scores is very strong. As expected, the strength of relationship varied among the categories.

Table 5

CORRELATION OF PROFILE EXAMINATION AND

NATIONAL BOARD OF MEDICAL EXAMINERS, PART 1, CATEGORIES

Category	r	r^2
Anatomy	.581	.338
Physiology	.670	.449
Biochemistry	.463	.214
Pathology	.686	.471
Microbiology	.562	.316
Pharmacology	.752	.566
Behavioral Sci	-	-
Total	.886	.785

The examinations generated by this system were not intended to replace professional certification examinations. The item library has generated examinations useful as an internal evaluation parameter. It is reassuring to observe their strong correlation with subsequent certification performance.

In summary, the Profile Examinations have desirable properties of reliability and validity. Additional reports of psychometric studies are available from the authors upon request.

Field Testing With Allied Health Groups

Field testing of allied health groups occurred throughout the second and third year of the Project. Profile Examinations for Physician Extenders (PEPE) were generated specifically for the purpose of assessing the information base for an allied health person as it is relevant to the curriculum of a Physicians Assistant. Generally, field testing data indicate validity in concept, of testing for mastery of information in order to tailor a curriculum for an allied health person who desires to become a Physician Assistant.

Field testing initially occurred at Sheppard Air Force Base where a group of physician assistant students took PEPE 1 (N = 28) and PEPE 2 (N = 27). Each examination consisted of 400 items relevant to the curriculum of the physician assistant.

This group of students had just completed their year of didactic experience.

Since this was the first PEPE field testing experience, a questionnaire was given each examinee upon completion of the examination. This feedback was anticipated to be useful in designing future PEPE exams. A copy of the questionnaire follows this narrative as Appendix D. According to the subject data and record of completion times, there appeared to be ample time allotted for completion of the items. The examination was reported as being worded in a clear and precise manner. Examinees generally felt that they could have answered 5-10% of the questions correctly prior to their PA curriculum at Sheppard. They felt that about 50% of the questions could be answered correctly as a function of their completing the curriculum. Although the examinees generally felt as though they could have answered correctly only 5-10% of the questions prior to their physician assistant curriculum, subsequent field testing indicated the figure to be higher; however, their estimate of 50% correct as a consequence of completing the curriculum was more accurate. The general impression was that about 80% of the items were relevant to the curriculum. The mean performance on PEPE 1 and 2 fell near the projected mean performance of Year 3 students in the University of Missouri-Kansas City School of Medicine six year combined B.S. and M.D. program. See Table 6.

Table 6

RESULTS OF PEPE 1 & 2 SUMMARIZED

QUESTIONNAIRE RESULTS

Ample time allowance
Wording clear and precise
Could answer 5-10% before PA program
50% after PA program
Considered 80% of items relevant to curriculum

UMKC STUDENT CLASS MEANS

Year	1	2		3	4		5	6
	30.0	37.4		52.9	58.2		63.4	67.9
28.3 PEPE 1 Low Score			46.7 PEPE 1 Mean			62.0 PEPE 1 High Score		

UMKC STUDENT CLASS MEANS

Year	1	2		3	4		5	6
	32.9	40.8		48.7	56.3		62.6	65.6
28.5 PEPE 2 Low Score			45.9 PEPE 2 Mean			58.0 PEPE 2 High Score		

These projected means are based on the item analysis data of those items which had appeared on previous Profile Examinations. One should note that the mean performance of 46.7% and 45.9% of the groups taking PEPE 1 and 2, respectively, is quite respectable, since the examinations tended to be more difficult than traditional classroom examinations where scores are expected to fall in the range of 70% - 100% correct. The range of scores for both PEPE 1 and 2 was observed to be quite large. The lowest scores observed, 28.3% and 28.5% for PEPE 1 and 2, respectively, were about what would be expected of people just entering the curriculum. On the other hand the high scores, 62.0% and 58.0% for PEPE 1 and 2, respectively, were above what item analysis data indicated to be the mean of Year 4 medical students (the medical students were enrolled in a six-year program).

Table 7

SUMMARY OF PEPE 1 & 2 PERFORMANCE BY CATEGORY

	NUMBER OF ITEMS		MEAN		STANDARD DEVIATION	
	PEPE 1	PEPE 2	PEPE 1	PEPE 2	PEPE 1	PEPE 2
Int. Med.	95	99	50.8	44.0	9.2	8.2
Pediatrics	86	94	46.7	40.2	5.8	6.7
Ob/Gyn	90	77	39.1	40.8	7.8	6.9
Basic Sci.	144	136	52.3	49.0	9.1	9.2
Physiol.	35	26	47.6	51.7	11.1	10.8
Biochem.	26	26	55.4	50.3	11.5	10.0
Anatomy	28	28	50.3	43.8	11.3	12.6
Pharm.	33	31	59.4	50.7	14.8	11.8
Micro.	24	25	49.1	48.6	9.6	10.3
Genetics	12	7	44.8	36.3	15.6	18.9
Infect Dis.	27	34	51.4	53.4	9.2	9.3
Neoplasms	19	24	38.4	40.9	13.1	9.8
Musculoske.	11	6	38.7	45.2	12.0	14.0
Digestive	11	16	44.8	34.8	17.3	11.1
Urogenital	14	18	49.7	48.2	14.2	12.5
Respiratory	11	7	48.5	33.7	17.5	12.1
Endocrine	17	17	46.2	36.5	12.5	12.6
CV	31	17	44.5	43.7	14.5	12.3
Hemic	22	18	38.2	43.3	13.0	11.9
Nut. & Metb.	10	15	44.1	45.3	15.0	12.0
Inj., Poi., Im.	9	14	37.4	32.1	10.1	11.9
Gen. Path.	11	14	49.8	41.4	17.6	11.5
Techniques	29	29	46.6	47.9	10.7	10.8
Neurology	12	15	37.0	51.9	12.7	8.4
Radiology	6	5	53.2	33.6	19.3	17.8
Behav. Sci.	11	10	62.6	41.1	13.2	17.0
Total	400	400	46.7	45.9	7.1	6.7

Mean performance by category is presented for PEPE 1 and 2 in Table 7. Furthermore, composite means were used to graph the profile of the physician extender's information base in selected categories of the examination. See Figure 22. Consistent with prior experience, the scores did represent a profile with varying levels of information base indicated. The relatively low score in Obstetrics-Gynecology was anticipated due to the minor portion of curriculum time spent on the subject. These students, however, likely improved their scores in the following year because of the time spent in Obstetrics-Gynecology. The profile of the physician assistant's information base indicated strengths in the areas of Physiology, Biochemistry, Pharmacology, and Behavioral Science. Another area of relative strength was observed to be Infectious Diseases. Neoplasms appeared to be an area of relative weakness.

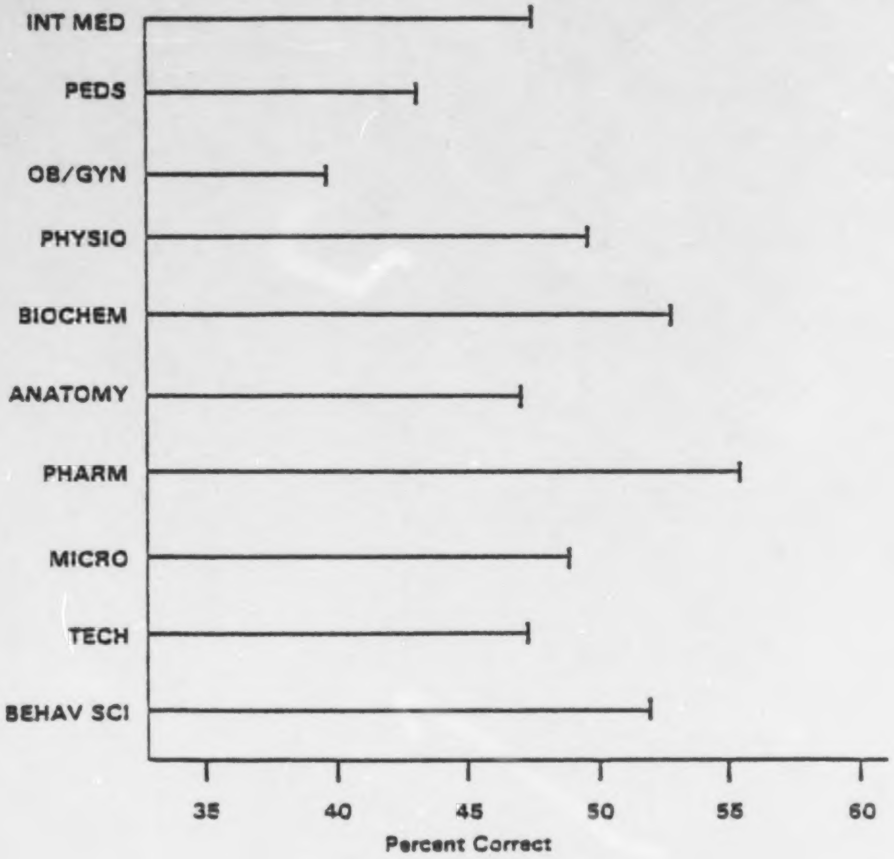


Figure 22. A Profile of The Physician Assistant's
Information Base
Post-Didactic

The second field testing experience occurred at Sheppard Air Force Base where a group of physician assistant students took PEPE 1 (N = 19) and PEPE 2 (N = 16). These students, unlike the previous field testing group, were just starting their year of didactic experience in the physician assistant program. Thus, the mean performance of this group of examinees was expected to be lower than that observed for the group who took the examinations subsequent to their year of didactic experience.

The overall mean performance of the group of students who were entering the physician assistant program fell near the level of Year 1 students in the University of Missouri-Kansas City School of Medicine six year combined B.S. and M.D. program. See Table 8. The mean performance on PEPE 1 and 2 was 31.3% and 31.5% correct, respectively. Recall that these examinations tend to be more diffucult than traditional classroom examinations where scores are expected to fall in the range of 70% - 100% correct.

Table 8

RESULTS OF PEPE 1 and 2 SUMMARIZED

FOR STUDENTS PRIOR TO PA PROGRAM

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
30.0	37.4	52.9	58.2	63.4	67.9

21.0	31.3	45.0
PEPE 1	PEPE 1	PEPE 1
Low Score	Mean	High Score

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
32.9	40.8	48.7	56.3	62.6	65.6

24.8	31.5	48.8
PEPE 2	PEPE 2	PEPE 2
Low Score	Mean	High Score

As Table 8 indicates, the students entering the physician assistant program performed at about the Year 1 medical student level (for this comparison group the medical students had just graduated from high school). There were, however, some beginning physician assistant students who achieved much higher scores. These people had obviously acquired significant medical information through education and experience. Such a system for assessing strengths and making curricular prescriptions would especially benefit these people who had previously acquired information. High scores achieved by some individuals entering the physician assistant program fell at the mean of the group performance for those students who had completed a year of their didactic experience in a physician assistant curriculum; therefore, it would appear reasonable to assume that these high scorers had sufficient information in certain content areas. Further curricular requirements in these areas could be waived.

Table 9 presents the mean performance of pre- and post-didactic groups on PEPE 1 and 2 by category. Some of the gains are quite impressive; for example, the pre-mean for Biochemistry, PEPE 1, was 29.2% correct, and the post-mean was 55.4% correct. Internal Medicine, Pediatrics and Basic Science were other areas where large gains were noticed.

Table 9

SUMMARY OF PEPE 1 & 2 PERFORMANCE BY CATEGORY WHICH COMPARES PA STUDENTS PRE AND POST DIDACTIC PROGRAM

	NUMBER OF ITEMS		MEAN			
	PEPE 1	PEPE 2	PEPE 1		PEPE 2	
			Pre	Post	Pre	Post
Int. Med.	95	99	34.0	50.8	31.3	44.0
Pediatrics	86	94	30.8	46.7	34.0	40.2
Ob/Gyn	90	77	28.7	39.1	30.5	40.8
Basic Sci.	144	136	32.1	52.3	30.4	49.0
Physiol.	35	26	29.5	47.6	29.4	51.7
Biochem.	26	26	29.2	55.4	30.5	50.3
Anatomy	28	28	31.4	50.3	25.5	43.8
Pharm.	33	31	37.8	59.4	31.3	50.7
Micro.	24	25	32.7	49.1	35.8	48.6
Genetics	12	7	34.7	44.8	29.4	36.3
Infect Dis.	27	34	36.1	51.4	38.1	53.4
Neoplasms	19	24	28.0	38.4	32.3	40.9
Musculoske.	11	6	34.0	38.7	30.2	45.2
Digestive	11	16	29.6	44.8	32.4	34.8
Urogenital	14	18	32.4	49.7	35.8	48.2
Respiratory	11	7	27.3	48.5	16.1	33.7
Endocrine	17	17	25.1	46.2	25.0	36.5
CV	31	17	23.5	44.5	29.1	43.7
Hemic	22	18	28.2	38.2	33.3	43.3
Nut. & Metb.	10	15	28.9	44.1	26.7	45.3
Inj., Poi., Im.	9	14	24.0	37.4	31.7	32.1
Gen. Path.	11	14	32.1	49.3	31.7	41.4
Techniques	29	29	31.0	46.6	32.1	47.9
Neurology	12	15	35.0	37.0	32.5	51.9
Radiology	6	5	36.0	53.2	30.0	33.6
Behav. Sci.	11	10	47.4	62.6	28.1	41.1
Total	400	400	31.3	46.7	31.5	45.9

The graphs, Figures 23 and 24 of the same material give a visual representation of the difference in pre- and post-didactic scores. The graphs depict well the gain in information that occurs as a function of completing the physician assistant program. These results indicated the capacity for this examination system to detect differences in levels of information

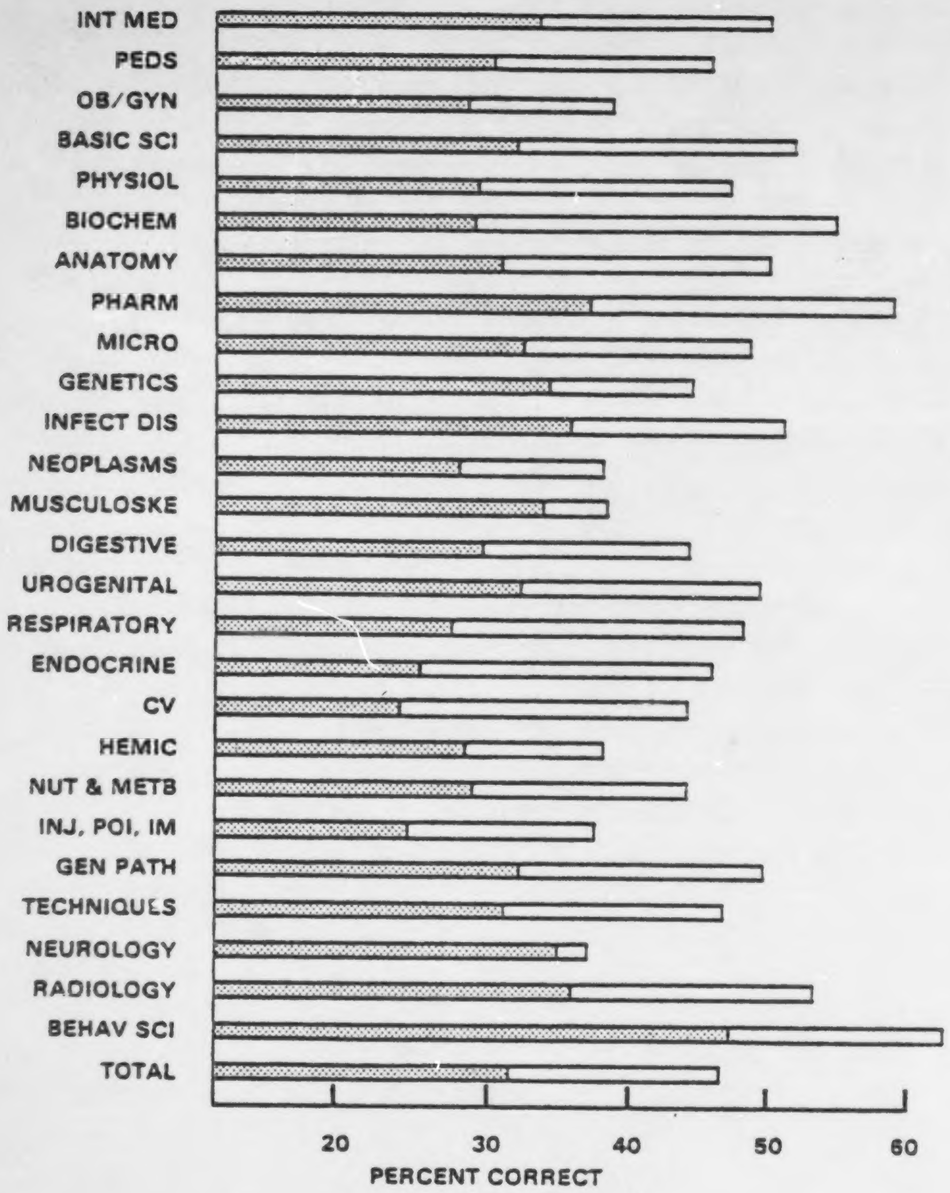


Figure 23. Comparison of Mean PEPE 1 Pre and Posttest for Physician Assistants

across content areas and between pre- and post-didactic groups for different individuals. A study presented later in this chapter presents data from a longitudinal study wherein the

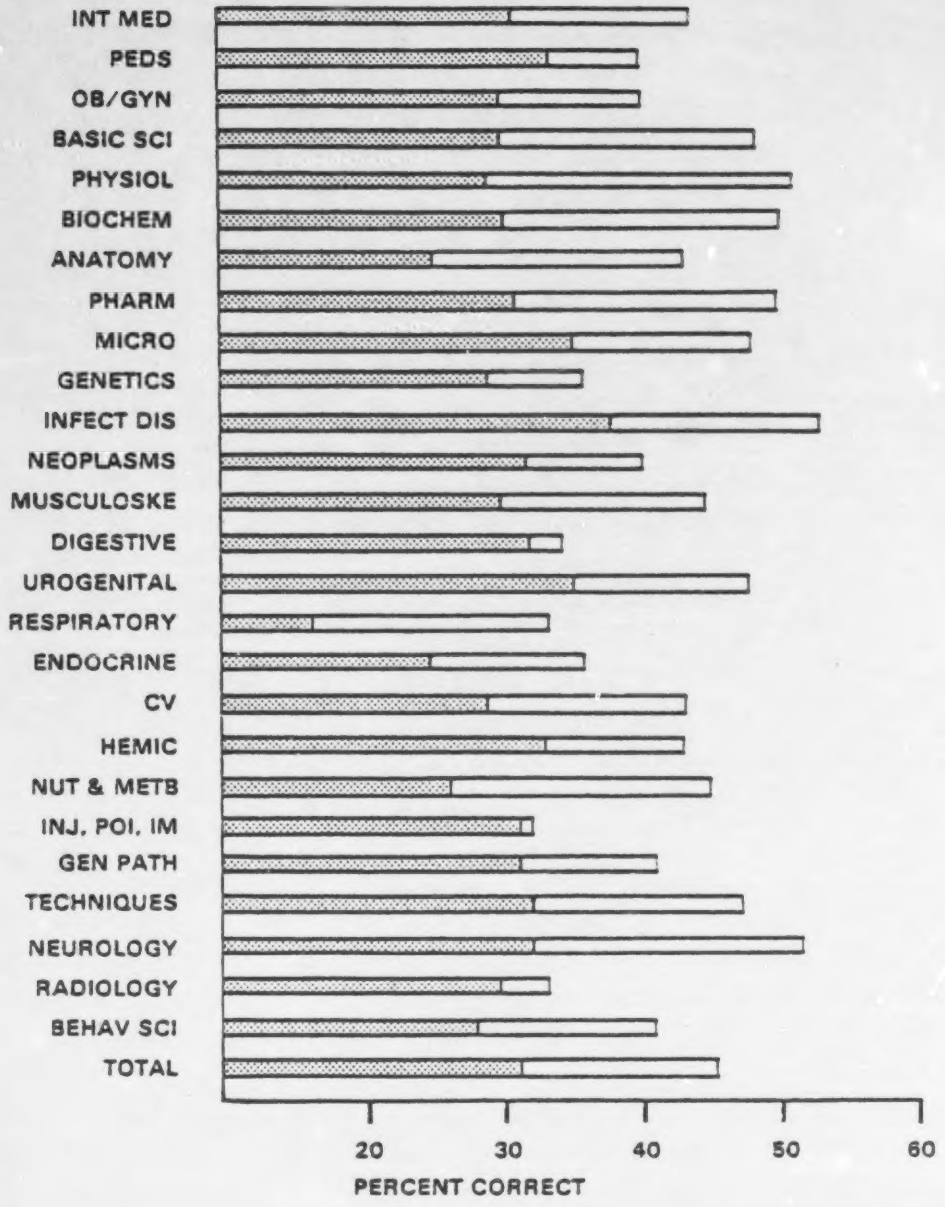


Figure 24. Comparison of Mean PEPE 2 Pre And Posttest for Physician Assistants

same individuals were examined at pre- and post-didactic occasions.

A third field testing experience occurred in Grand Rapids, Michigan where 53 respiratory therapy and radiologic technology students took PEPE 1 and 2. A few faculty/staff members participated in the field testing; however, the majority of participants were still in their respective educational programs.

First, the performance of radiologic technology and respiratory therapy students is summarized in Tables 10 and 11 by comparing their performance with that of UMKC medical students.

Table 10

RESULTS OF PEPE 1 & 2 SUMMARIZED FOR RESPIRATORY THERAPY STUDENTS

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
30.0	37.4	52.9	58.2	63.4	67.9

PEPE 1 Low Score	PEPE 1 Mean	PEPE 1 High Score
30.8	31.5	32.5

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
32.9	40.8	48.7	56.3	62.6	65.6

PEPE 2 Low Score	PEPE 2 Mean	PEPE 2 High Score
26.0	28.6	31.8

Table 11

RESULTS OF PEPE 1 & 2 SUMMARIZED FOR RADIOLOGIC TECHNOLOGY STUDENTS

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
30.0	37.4	52.9	58.2	63.4	67.9

PEPE 1 Low Score	PEPE 1 Mean	PEPE 1 High Score
20.8	26.8	33.3

UMKC STUDENT CLASS MEANS
BY YEAR

1	2	3	4	5	6
32.9	40.8	48.7	56.3	62.6	65.6

PEPE 2 Low Score	PEPE 2 Mean	PEPE 2 High Score
16.0	23.4	31.8

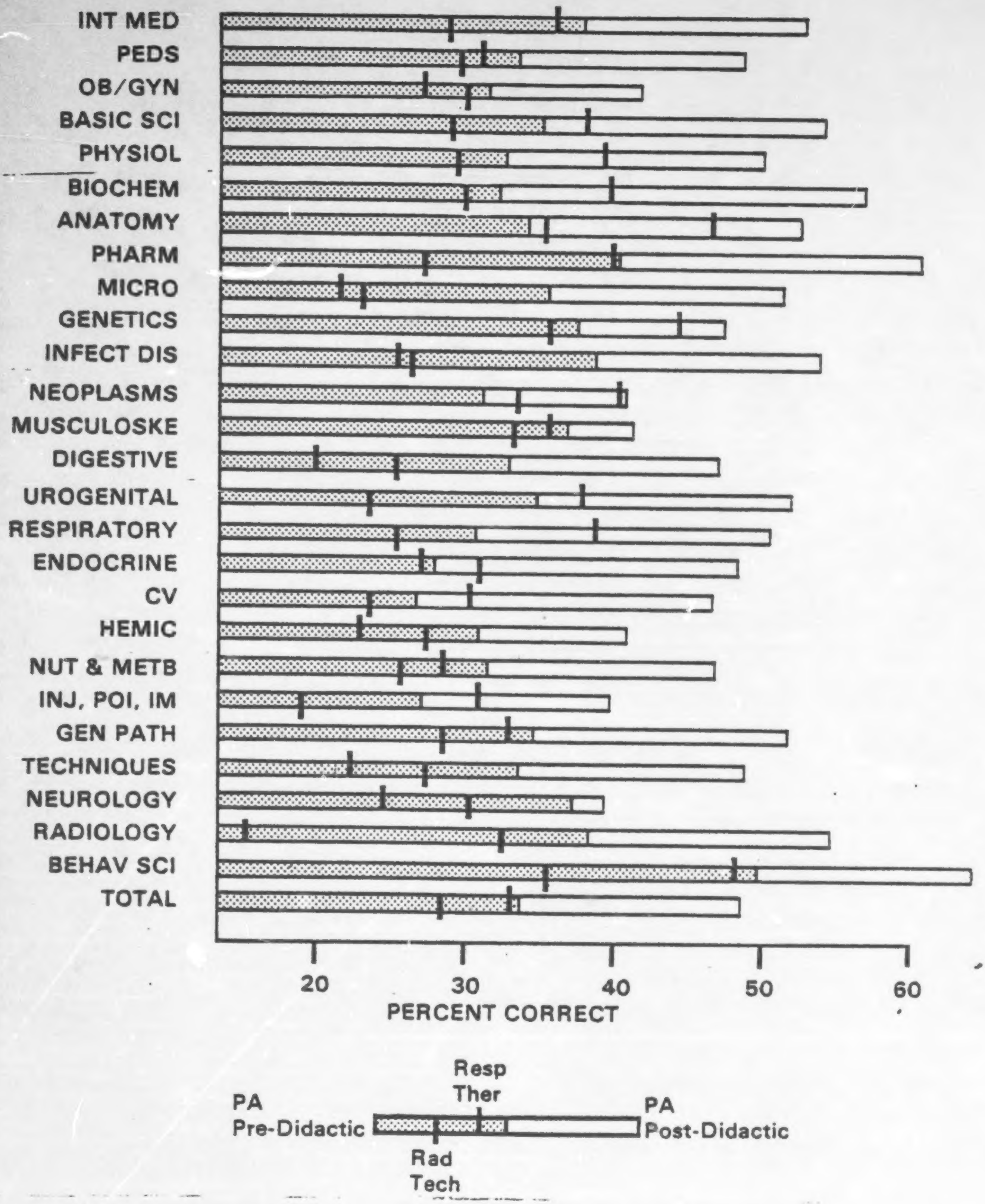
It is not surprising that the total score performance was low because the exam is very difficult.

Next, PEPE 1 and 2 performance of the radiologic technology and respiratory therapy students is compared in Table 12 with that of the physician assistant students who took the examinations at the end of their didactic experience. Again, it is noted that these examinations were very difficult for students at this level; therefore, the results should not in any manner, be interpreted as an adverse reflection on the students involved in this field testing experience. Indeed, they are to be

Table 12

PEPE 1 & 2 MEAN PERFORMANCE BY CATEGORY FOR RESPIRATORY THERAPY, RADIOLOGY TECHNOLOGY & PHYSICIAN ASSISTANT STUDENTS

	PEPE 1				PEPE 2			
	Pre PA	Post PA	Resp	Rad Tech	Pre PA	Post PA	Resp	Rad Tech
Int. Med.	34.0	50.8	33.0	26.2	31.3	44.0	26.5	20.3
Pediatrics	30.8	46.7	28.7	27.0	34.0	40.2	28.5	23.4
Ob/Gyn	28.7	39.1	25.6	27.7	30.5	40.8	27.3	25.0
Basic Sci.	32.1	52.3	35.2	26.6	30.4	49.0	30.9	24.8
Physio.	29.5	47.6	37.1	26.7	29.4	51.7	38.5	27.7
Biochem.	29.2	55.4	37.2	26.9	30.5	50.3	28.5	22.1
Anatomy	31.4	50.3	44.0	33.0	25.5	43.8	34.3	28.6
Pharm.	37.8	59.4	37.4	25.3	31.3	50.7	27.7	22.2
Micro.	32.7	49.1	19.5	20.8	35.8	48.6	25.6	23.4
Genetics	34.7	44.8	41.7	33.8	29.4	36.3	17.1	27.9
Infect Dis.	36.1	51.4	23.4	24.1	38.1	53.4	28.2	20.7
Neoplasms	28.0	38.4	38.6	31.1	32.3	40.9	31.7	24.8
Musculoske.	34.0	38.7	33.4	30.5	30.2	45.2	13.3	13.2
Digestive	29.6	44.8	18.2	23.2	32.4	34.8	26.3	16.8
Urogenital	32.4	49.7	35.7	21.8	35.8	48.2	21.1	19.3
Respiratory	27.3	48.5	36.4	23.6	16.1	33.7	17.1	17.3
Endocrine	25.1	46.2	25.5	28.2	25.0	36.5	16.5	20.8
CV	23.5	44.5	28.2	21.9	29.1	43.7	28.2	21.6
Hemic	28.2	38.2	21.2	25.9	33.3	43.3	22.2	19.3
Nut. & Metb.	28.9	44.1	26.7	24.0	26.7	45.3	28.0	16.9
Inj.,Poi.,Im.	24.0	37.4	29.7	17.8	31.7	32.1	22.9	22.9
Gen. Path.	32.1	49.8	30.3	26.4	31.7	41.4	28.6	21.4
Techniques	31.0	46.6	20.7	25.7	32.1	47.9	26.2	23.6
Neurology	35.0	37.0	22.3	27.9	32.5	51.9	26.7	21.1
Radiology	36.0	53.2	11.2	30.0	30.0	33.6	40.0	13.6
Beh. Sci.	47.4	62.6	45.5	33.6	28.1	41.1	28.0	22.1
Total	31.3	46.7	31.5	26.8	31.5	45.9	28.6	23.4



PEPE 1 Performance by
Figure 25. Category Which Compares Respiratory Therapy, Radiologic Technology and Physician Assistant Students

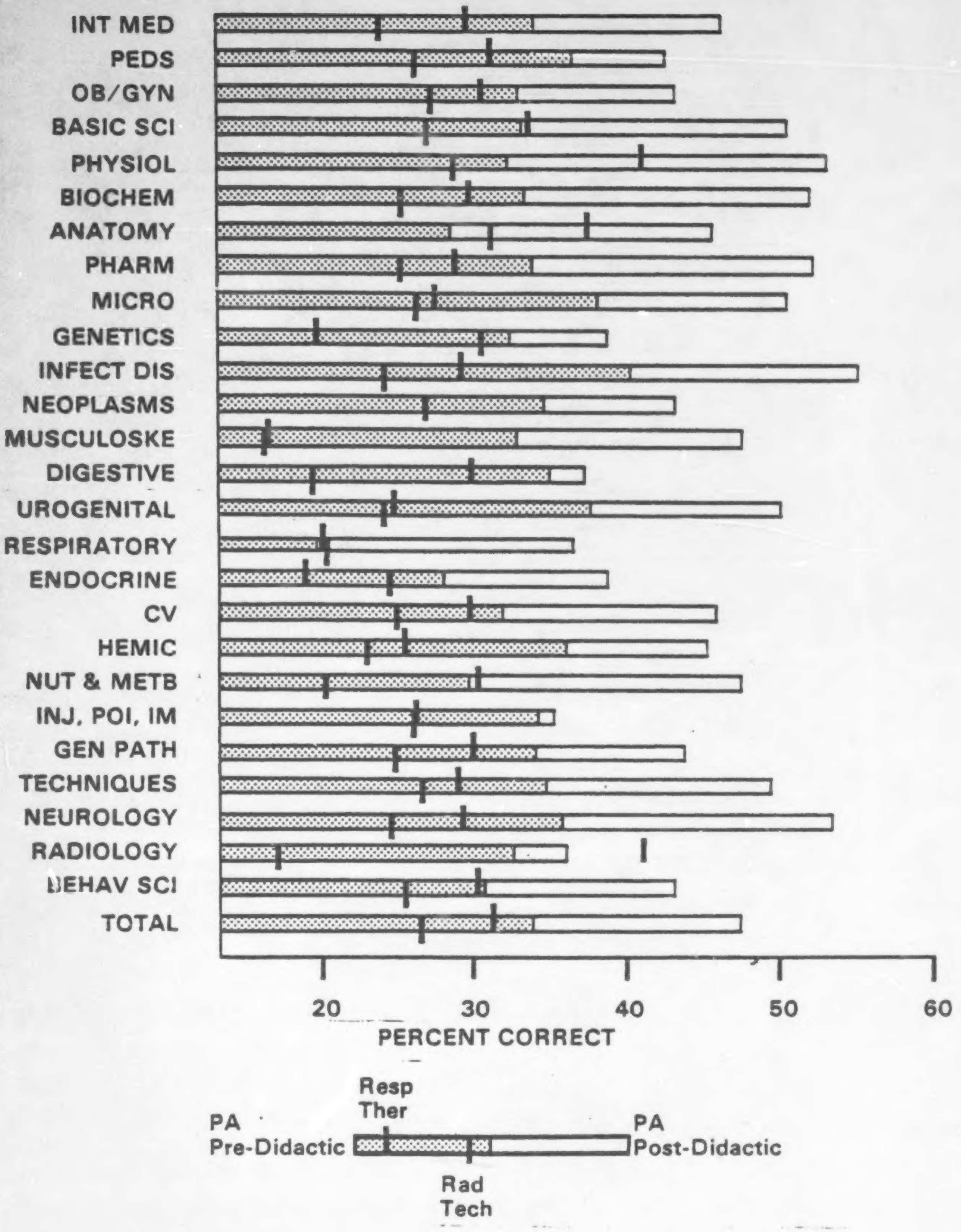


Figure 26. PEPE 2 Performance by Category Which Compares Respiratory Therapy, Radiologic Technology and Physician Assistant Students

commended for undergoing what must have been a frustrating experience. Furthermore, the number of items in Radiology, for example, was much too small to be of statistical significance.

While the scores, in general, are below the level achieved by physician assistant students upon completion of their didactic experience, several interesting observations arise when considering Figures 25 and 26. These graphs depict respiratory therapy, radiologic technology, and physician assistant student performance. Additionally, physician assistant performance is presented for groups pre- and post-didactic experience. No radiologic technology students exceed that of the physician assistant students who had completed the didactic experience; however, in both PEPE 1 and 2 the respiratory therapy students performance exceeded that of pre-didactic physician assistant students in the basic science areas of physiology and anatomy. This observation illustrates the concept of the profile examination as a means of assessing core information. It would be worthwhile to examine respiratory therapy and radiologic technician students upon completion of their didactic experience in order to note gains in information as assessed by the profile examination.

During the Spring, 1977, 63 senior students in allied health programs at the University of Kansas and the University of Missouri took PEPE 3A (N = 33) and PEPE 3B (N = 30). PEPE 3A and 3B were each 200 item examinations which were constructed by pulling items from PEPE 1 and PEPE 2. The difficulties in persuading people to participate in field testing indicated that it was necessary to abbreviate the examination in order to attract participants. Furthermore, the use of items previously field tested allowed the comparison of current performance of allied health participants with physician assistants who had previously taken those items.

The mean percent correct by various groups on PEPE 3A and PEPE 3B is presented in Tables 13 and 14. Again, the data indicated areas of strength and weakness of various groups with regard to the anticipated level of information characteristic of the physician assistant. For example, this group of medical technologists exceeded the mean performance of physician assistants in the area of microbiology on PEPE 3A. Although the use of test scores on an individual basis for curricular prescription is preferred to the use of group scores, group data were helpful in demonstrating the overall validity of the profile concept.

The medical dietetics as a group exceeded the group performance of physician assistants in the area of biochemistry for both PEPE 3A and PEPE 3B. On PEPE 3A, the medical dietetics performed as a group above the mean of the physician assistants in the area of nutrition and metabolism.

Table 13

MEAN PERCENT CORRECT BY VARIOUS GROUPS ON PEPE 3A

	Pre-PA (19)	Med Tech (23)	Occ Tx (3)	Med Diet (6)	Post PA (27)
Int Med	33.6	40.2	33.9	36.9	57.6
Peds	32.4	43.1	30.2	33.3	60.5
Ob/Gyn	27.8	35.3	34.7	30.0	63.6
Basic Sci	29.0	40.9	34.1	49.2	59.6
Physiology	24.1	39.4	40.0	58.4	56.1
Biochem	29.5	40.4	30.9	65.5	62.3
Anatomy	34.0	32.9	37.5	39.6	58.7
Pharm	25.9	30.4	24.1	33.3	57.5
Micro	30.4	63.1	30.6	44.4	62.2
Infect Dis	42.5	45.6	23.8	21.4	68.2
Nut & Metb	27.7	49.8	36.4	60.6	55.7
Techniques	29.5	49.4	29.2	45.8	54.6
Total	30.8	40.4	30.5	40.5	59.6

Table 14

MEAN PERCENT CORRECT BY VARIOUS GROUPS ON PEPE 3B

	Pre-PA (16)	Med Tech (18)	Resp Tx (2)	Med Diet (7)	Post PA (27)
Int Med	30.9	40.4	45.0	39.5	59.3
Peds	36.4	42.2	40.9	44.2	59.7
Ob/Gyn	28.0	31.8	33.3	29.2	53.6
Basic Sci	30.2	43.5	46.5	48.2	60.7
Physiol	25.1	40.4	39.5	48.9	53.9
Biochem	29.9	51.3	52.9	70.6	66.5
Anatomy	25.7	33.0	46.9	33.1	55.3
Pharm	32.7	30.4	38.2	36.1	62.8
Micro	37.8	61.1	54.2	50.0	68.8
Infect Dis	40.0	42.3	35.7	30.6	65.8
CV	29.3	30.8	63.6	32.5	56.0
Hemic	31.7	58.9	25.0	40.0	60.5
Total	31.2	41.1	43.8	42.9	59.4

Final field testing for the Project period occurred in May of 1977 as a group of physician assistant students completed their year of instruction at Sheppard Air Force Base. Twenty-four students were included in the group and were the same individuals who had been given a pretest examination prior to their instructional period. This experience was especially valuable since it afforded an opportunity to collect longitudinal data (pre- and posttests) on the same individuals.

Profile examinations used as pre- and posttests were generated according to content specifications derived from curricular matrix data. However, the faculty of the School of Health Care Sciences at Sheppard did not generate the questions used. Thus this longitudinal study was a real test for the general ability of the profile examination to measure gain in information associated with the one year didactic experience.

Pre- and posttest results (means and their associated *t*-tests) are presented in Table 15. As indicated by the data, score differences were statistically significant in all but three categories. The profile examinations were effective in detecting pre- and posttest differences in levels of information. This sensitivity to gain in information should be expected of examinations used for purposes of curricular prescription.

Table 15

PRE AND POSTTEST DIFFERENCES FOR

SCORES OF PHYSICIAN ASSISTANT STUDENTS

	MEAN		
	PRE	POST	t-ratio
Med	34.0	53.5	8.06**
Peds	33.5	57.0	11.24**
Ob/Gyn	29.1	44.0	6.39**
Basic Sci	32.6	50.6	8.34**
Physio	30.8	49.4	5.64**
Biochem	31.3	46.6	4.57**
Anatomy	29.6	57.6	9.12**
Pharm	36.0	52.1	6.60**
Micro	35.1	46.4	3.14**
Infect	40.1	54.7	4.61**
Neopl	29.9	46.7	5.08**
Muscu	36.1	45.9	2.41*
Digest	31.6	54.8	5.65**
Resp	21.6	50.5	7.82**
Endo	26.9	36.4	2.90**
CV	28.7	59.3	6.20**
Hemic	31.3	50.4	4.26**
Nut	29.9	56.0	7.39**
Inj	26.8	39.9	1.97
Path	22.4	48.0	6.44**
Tech	39.2	50.5	1.91
Behav	43.4	52.0	1.59
Total	36.1	46.0	2.63*

---

df = 23
** $p < .01$
* $p < .05$

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APPENDICES

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Appendix A.1

SYSTEM DESCRIPTION

The original charge to the computing staff of the PEPE Project was to develop a computer system by which examination questions could be stored, retrieved, scored, and analyzed with the end result being the identification of educational deficiencies in anyone who took an examination consisting of these questions. Such a system has been designed and implemented. It meets the requirements of the contract and even offers extra features not originally envisioned.

Consisting of over 50 programs and more than 11,000 lines of code, the system is currently running on the Computer Network of the University of Missouri. Since the design took into account the fact that a computing utility would be used rather than an "in-house" computer, the system is easily adaptable to either environment, which should make replication easier. (Further information on this can be found in Appendix A.4: Replication Considerations.)

To describe what these programs do, functions were grouped into six sub-systems which deal with a particular facet of the testing cycle. Each of the system descriptions is an account of what happens from a technical viewpoint. While not really a sub-system, the SEARCH program, which retrieves questions from the Item Library, is such an important part of the entire effort that the entire guide to its operation was included in Appendix A.2.

Since the reader may not be familiar with some words used in computing, brief definitions of a few that are used throughout this report are presented below.

Byte - A single character or one location in a computer's memory.

Field - A single data element. A MeSH code, one line of an answer, a date, etc.

Record - A collection of logically related fields. All information about one question is a record.

File - A collection of records. All questions in the Item Library constitute a file.

Alphanumeric - A field that may contain letters or numbers.

Terminal - A device with a typewriter-like keyboard and a paper or video display area used by an individual to interact with a computer.

Dataset - An electronic device used to connect a terminal with a computer.

On-line - The state a terminal obtains when it is hooked to the computer and data are being exchanged.

It should be noted that some time was spent by the programming staff on efforts not documented here. The most notable here is the conversion from 4-level to 7-level MeSH codes, necessitated by the National Library of Medicine's change in their coding scheme. It was a function which will never be repeated, hence the lack of narrative on the subject.

ITEM LIBRARY

A main focal point of the PEPE Project has been the development of a large set of questions on medicine. This question collection is known as the item library. Most of the activity in the Computer Center has been aimed at creating, maintaining, and disseminating information from this database. It is important, therefore, to basically describe the technical philosophy behind the item library in order to understand the full capabilities of the system. The basic structure of the physical files and how they interact when questions are entered, retrieved, or deleted will be presented.

The item library in reality is a set of three physical files that are mutually dependent on each other for the successful operation of the system. These files are called the ITEMFILE, the INDEX, and the POINTER file.

The ITEMFILE contains all the information about the question, e.g. the text, the reference, the item analysis and so forth. The records it contains are, by most standards, quite large due to the quantity of textual information that must be stored. A detailed listing of how the 3,665 characters in this record are allocated is presented below.

```
DCL 1 ITEM_REC BASED (LOCATION),                    OFFSET   LENGTH
      2 STATUS_BYTE        CHAR(1),                      0        1
      2 QUESTION(21)       CHAR(72),                     1     1512
      2 ANSWERS(5,3)       CHAR(61),                  1513      915
      2 ANSWER             FIXED BIN,                 2428        2
      2 MESH#              FIXED BIN,                 2430        2
      2 MESH_CODES(15)     CHAR(28),                  2432      420
      2 REFERENCE          CHAR(72),                  2852       72
```

```
                                                    OFFSET   LENGTH
     2 SOURCE              FIXED BIN,               2924         2
     2 DATE_IN             CHAR(4),                 2926         4
     2 UPDATE              FIXED DEC(6),            2930         4
     2 REVIEW_DATE         CHAR(4),                 2934         4
     2 REVIEWER            FIXED BIN,               2938         2
     2 LAST_NO             FIXED BIN,               2940         2
     2 USE_HISTORY         BIT(64),                 2942         8
     2 LAST_ANAL(6,7)      FIXED BIN,               2950        84
     2 TOTAL_ANAL(6,7)     FIXED BIN,               3034        84
     2 DI#                 FIXED BIN,               3118         2
     2 DI#                 FLOAT,                   3120        16
     2 PEPE_HISTORY        BIT(64),                 3136         8
     2 PEPE_ANAL(6,9)      FIXED BIN,               3144       108
     2 PEPE_RESERVED       FIXED BIN,               3252         2
     2 PEPE_DI#            FIXED BIN,               3254         2
     2 PEPE_DI(4)          FLOAT,                   3256        16
     2 RESERVED            CHAR(393);               3272       393
                                                    3665 = LRECL
```

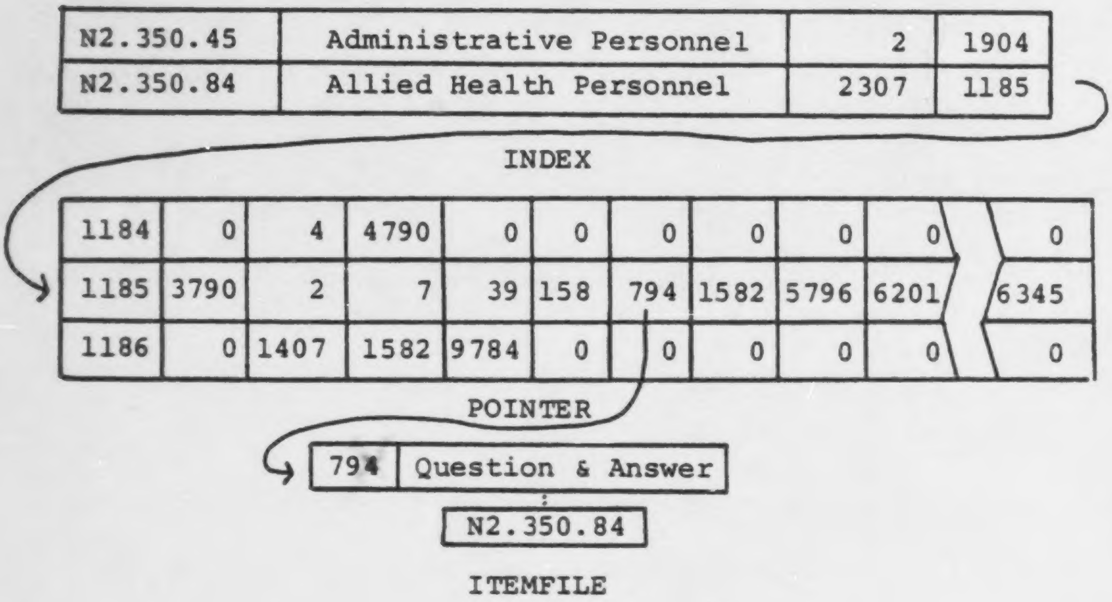
The INDEX file contains the MeSH codes. There are roughly 17,000 records in this dataset, virtually every code that the National Library of Medicine has devised. Besides the code itself, there is an alphabetic description of the subject area the code is representing.

The third file is the POINTER dataset which shows the correlation between questions and MeSH codes. There is an entry in the POINTER file for each occurrence of a MeSH code in each question. This technique allows for an unlimited number of questions to be associated with a particular code, the only constraint being the actual amount of space available for the file.

Please refer to Figure 1 during the following discussion.

The INDEX file has all records stored in ascending MeSH code order. In the small subset shown in the example we have the code assigned to all PEPE questions (Allied Health Personnel) and the codes that immediately precede and follow N2.350.84. The first number after the literal description of the code is a counter indicating how many records in the ITEMFILE have this MeSH. The second number points to the first record in the POINTER file that is associated with this MeSH code. Each pointer record contains 103 "slots" to store an item number. In our example the MeSH code N2.350.84 points to record 1185 in the POINTER file. This record in turn says that this MeSH will be found in records in the ITEMFILE numbered 2, 7, 39, 158, 794, 1582, etc.

When the system is initially generated, the POINTER file is pre-formulated and all "slots" contain zeros. The first position contains a contiguous, ascending sequence number ranging from 1 to N. (N is currently 13,999.) The second position is



N2.350.45	Administrative Personnel	2	1904
N2.350.84	Allied Health Personnel	2307	1185

1184	0	4	4790	0	0	0	0	0	0	0
1185	3790	2	7	39	158	794	1582	5796	6201	6345
1186	0	1407	1582	9784	0	0	0	0	0	0

794	Question & Answer

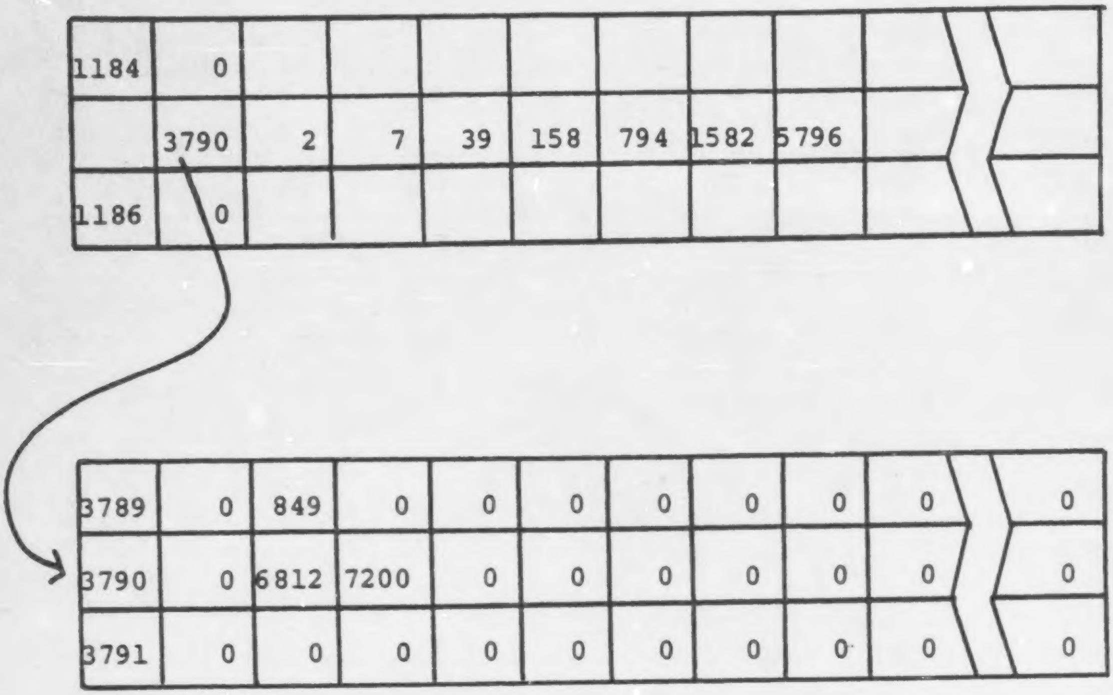
N2.350.84

Figure 1

normally a zero unless there are more than 103 questions in the ITEMFILE with the same MeSH code. When this situation occurs, a second pointer record is "chained" to the first. Figure 2 gives an example. All programs in the system recognize that since the second position of the pointer record is non-zero, it must be pointing to the next series of item numbers. In this case, record 1185 points to record 3790 where it is found to have more item numbers that contain MeSH code N2.350.84. The zero in the second position indicates the end of the "chain". If a positive integer were there instead, it would point to the next record containing item numbers.

An infinite number of records may be "chained" together, limited only by the amount of disk space available. The system knows where the next "free" pointer record is and how many are left from information contained in the very first record in the file, the MASTER RECORD. This first record contains totals on five different values, and helps the system to keep track of itself.

Descriptions of other parts of the system will relate what happens to these files as records are entered, deleted or retrieved for use. Keep in mind that most programs use these three datasets as they perform their given task.



1184	0									
	3790	2	7	39	158	794	1582	5796		
1186	0									

3789	0	849	0	0	0	0	0	0	0	0
3790	0	6812	7200	0	0	0	0	0	0	0
3791	0	0	0	0	0	0	0	0	0	0

Figure 2

QUESTION GENERATION

All questions submitted for inclusion in the item library are eventually typed on an ITEM BANK QUESTION FORM. Utilizing a UNIVAC 1810 keypunch, the forms are transcribed to cards and submitted to the QUESTION EDIT program (MEDIB06). The cards are checked for correct sequence numbers, and tests are performed on several of the fields for reasonableness (e.g., the correct answer may only be between 1 and 5).

The printout from this program is checked for errors and, if any are found, they are corrected and the program is re-run. This process continues until an errorless printout is obtained. At this point, the cards are run with the ITEM ADD program (MEDIB03). This program converts the set of cards for each question into a single record for inclusion in the ITEMFILE. Each MeSH code in the card set is looked up in the INDEX file. If a match is found, an entry is made in the appropriate POINTER record. If the MeSH code does not exist, an error message is printed.

When all cards have been processed, a final total of questions added is printed for the batch which can be compared with the number of forms originally keypunched. If the numbers do not agree, a check is made of all data until the discrepancy is found.

QUESTION UPDATING

A question stored in the Item Library may need modification of its contents for two reasons. It may not have been initially entered correctly or through review it is noted that a field within the record needs to be changed. Any such situation can be handled with expediency using the on-line updating program, MEDIT03.

In operation, the program retrieves the appropriate questions, receives the updates from the terminal operator, rewrites the question containing the new information, and creates a copy of the changes made on a separate file which is used for auditing and control.

After invocation, the program will ask if a list of codes and their meanings should be displayed. If a reply of "yes" is entered, a list will appear each time a new code is needed. This can be quite time consuming on a slow speed terminal. It is suggested that the operator either memorize the nine codes or write them down on an external list.

The codes and their functions are as follows:

Code	Function (Portion of Item Record to Update)
1	Question
2	Text Answers
3	Numeric Answer
4	Reference
5	Source
6	Add MeSH Code
7	Delete MeSH Code
8	Delete Question
9	End Changes

The update cycle is as follows:

The program asks:

ENTER ITEM NUMBER:

A number between 1 and the highest item number is entered. If the number points to a non-active item, an error message will be displayed. When a valid item is found the program asks for a

CODE:

A number between one and seven is entered. After appropriate changes, a new

CODE:

message is displayed. Another portion of the item may be changed or a code of nine may be given which will re-write the item and produce the audit record.

If an initial code of eight is given, the program will ask specifically

DO YOU WANT ITEM DELETED:

A reply of "yes" or "no" must be given. This is used to prevent accidental deletion of items by inadvertently entering an eight. If a positive response is given, the question is deleted and the program will ask for the next item number.

The program is basically designed to update only those fields that are humanly generated. Such information contained in the item record as the item analysis, usage history, etc. is machine generated and machine updated. An error in this type of data means that a major error has occurred elsewhere in the test processing system and will have to be fixed before the item records involved will be correct. Errors of this type do not lend themselves to manual correction, hence no provision is made to dynamically update the fields affected.

EXAMINATION GENERATION

An examination is generated by an initial selection of questions that have the potential of being on the examination in question. Utilizing the SEARCH program (MEDIB15), a stock printout is created that has from 20%-25% more questions than will actually be used on the test. These items are checked for validity and discrimination reliability and those that qualify are assembled into a dress rehearsal.

The dress rehearsal is reviewed by those people who are knowledgeable in the particular fields the test covers. They may make comments on the appropriateness of any question or may make minor technical changes to its content.

When all reviewers are finished with the dress rehearsal, a final set of items is identified and, using the SEARCH program, a copy of the test is produced that is ready for printing. If desired, another copy can be produced with the correct answer given for each question. This may be distributed after the exam is given for use as a learning reinforcement tool.

Once the exam is printed, two other programs are run to help the staff involved with test generation. One (MEDIB11) creates two listings showing the correlation between test number and the number of that question in the item library. The second (MEDIB12) compresses the large initial deck of item numbers that were used to create the test into a very small manageable card deck. This small deck is used later to add the item analysis data to the item library.

For a more complete discussion on the parameters used to select the initial dress rehearsal questions, refer to the section of this report entitled TEST CONSTRUCTION, ADMINISTRATION, INTERPRETATION AND CURRICULAR PRESCRIPTION.

EXAMINATION SCORING

The test answer sheets are read by an optical scanner and translated onto punched cards, 4 cards for each side of a page. The scanner obtains control information from the top of the page, which consists of the examinee's ID number, classification and location code, and the test sheet number and side number. This information is recorded on all 4 cards for the first side, along with the card number (1-4) and 50 of the 200 responses on the side. The responses are translated down 1 number, i.e., a 1 is recorded as a 0, etc. The second side of the test sheet also contains the sheet number and side number, and this is recorded on all 4 cards for the second side along with the card number and 50 of the 200 responses on that side.

The cards are then sorted together by test sheet number, side number, and card number and placed on a disk filled in a card image format. The answer key is also included, with all the control information containing zeros.

Program MEDTB01 combines the card image file with a deck of cards containing the category numbers and questions in each category, and a control card containing the number of questions per card, the number of categories in the test, and the number of pages per test sheet. This information is written out to a new file and the following listings are produced;

1. A listing of the control information and category cards
2. A listing of any records with either invalid data (wrong classification or location code) or possibly invalid data (ID number not found or excessive blank responses)
3. A listing of ID numbers and their corresponding test sheet number, sorted by ID number

Program MEDTB02 does the actual scoring of the tests and uses the file created in MEDTB01 along with an optional deck of cards containing question numbers to be dropped for key validation. This program creates 2 files, one with the scores and the other with statistical information, and produces the following listings:

1. A listing of the questions dropped (if any) for key validation
2. A listing of all the questions and the categories in which they are contained
3. A listing of any records which could possibly contain invalid data based on the results of statistical tests

4. The number of people in each classification (or year)
5. The number of questions in each category
6. The average number of correct responses in each category by both classification number and by location code
7. The standard deviation of each category by classification

Program MEDTB03 uses the two files created by MEDTB02 to produce the test results listings based on a control card containing the type of listing desired (whether by classification or location code, with or without the names, etc.).

Program MEDTB04 uses the file created by MEDTB01 to produce a listing of the item analysis for each question and to optionally write the item analysis out onto a tape.

Program MEDTB05 uses both the file created by MEDTB01 and the file containing the scores created by MEDTB02, along with an optional deck of cards containing the questions to be dropped for key validation, to produce a listing of the Kuder-Richardson (KR/20) statistical analysis.

CURRICULAR MATRIX

A major design requirement of the Curricular Matrix was that it must be modular in nature to allow for growth. There was no way to foretell how many schools and disciplines would be included in the matrix. To keep the design as open-ended in as many directions as possible, a hierarchical logical structure which is shown in Figure 3 was implemented. It was felt that this design would provide maximum flexibility for present and future requests of Curricular Matrix Information.

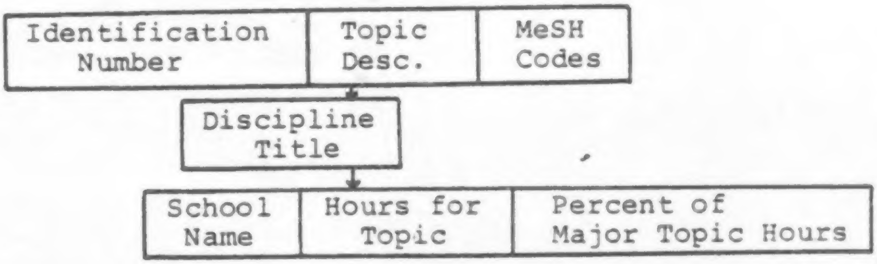


Figure 3

The Identification Number serves a dual purpose: first, to uniquely identify the Topic Description and associated information (i.e., Discipline Title, School Name) when doing some type of maintenance on the Curricular Matrix; and secondly, for production of reports. The Curricular Matrix has major topics which are then further divided into more specific topics. The Identification Number is used for indentation purposes in these reports.

The Identification Number consists of 8 digits with four levels. Figure 4 exemplifies how the four levels and indention are associated.

Indention	Identification	Topic Report Description/Appearance
0	020000000	Anatomy & Physiology
1	020200000	Integumentary System
2	020202000	Skin
1	020400000	Musculoskeletal System
0	080000000	Genetics
1	080200000	Mitosis

Figure 4. Elements of the Curricular Matrix

The Topic Description is textual information and is only used for reporting purposes.

The MeSH codes associated with the Topic Description are in a logical expression (using AND, OR's, NOT's, and MeSH codes). The logical expression describes the topic in subject areas represented by the MeSH codes. This logical expression, with the Identification Number, is then used to count the number of questions in the Item Library which fulfills the logical expression. The Identification Number is used to associate the question count with the proper Topic Description. This will be described in detail later.

The Discipline Title is used to title and group the schools which have programs in that discipline. The Discipline Title is used for report titles. It is possible that there may not be a Discipline Title for a particular Topic Description. This is dependent upon whether there are schools emphasizing that particular Topic Description. It is also possible that there could be multiple disciplines for a particular Topic Description.

School Name identifies which school the hours for topic applies. There will only be information at this level if the school has a certain number of hours to be completed under this specific Topic Description Title.

The Percent of Major Topic Hours filed is computed by adding up all the hours within the same level 1 (first two digits of Identification Number; Figure 4) for a particular discipline and school. This total is then used to calculate the percentage a particular school's hours contributes toward the major topic.

Maintenance of the Curricular Matrix is performed by two jobs. The first actually changes the collection of information. A transaction identifier is used to tell which information in the matrix is to be added to, modified, or deleted. Due to the nature of the logical structure of the matrix, to do some type of maintenance on the Discipline Title of School Information (percent of major topic hours isn't modifiable) one has to identify the particular Identification Number and Discipline Title. The second maintenance program calculates the Percent of Major Topic Hours field.

Production of a report is a multi-step procedure. The Item Library is constantly changing, so to ensure accurate question counts, which appear on reports, two programs are required. The first program takes a copy of the Identification Numbers and their associated MeSH code expression. This information is passed to the second program. This program evaluates the MeSH code expression and determines which questions in the Item Library satisfy the expression and totals the number of questions. The Identification Numbers and question counts are stored so that at another time reports can be generated using the Curricular Matrix and question count information. Connection of a particular topic description and the number of questions that satisfy the MeSH code expression are connected by the Identification Number.

The Curricular Matrix is implemented in MARK IV which supports the type of logical structure described here. As a result, changing the format of a report is a fairly simple procedure. It is possible to printout all or part of the data in many different formats simply by changing several of the MARK IV cards. It is also relatively easy to add new pieces of data to the structure if the need should arise.

For further discussion of the use of the matrix, please refer to the section titled ANALYSIS OF CURRICULA.

SELF EXAMINATION PROCEDURE (TEST)

In addition to batch generation of examinations, on-line self examination is possible. This feature allows for self paced computer assisted instruction. The following narrative (pages 82-90) is the set of instructions presented to the user upon request at the CRT terminal.

The following instructions describe the capabilities and operation of the Self-Examination Procedure, the "test" program. With the aid of a CRT terminal, the program will help you to evaluate your knowledge of a specific area of medicine. The specified area may be as broad or as narrow as you choose. Questions will be retrieved from an Item Library which contains thousands of Items. Some of the questions have appeared on past Quarterly Profile Examinations, some may appear on future exams.

Questions will be displayed, you will choose an answer and be informed immediately if you are right or wrong. At the end of a set of questions, the program totals up your score.

All questions in the Item Library have been categorized according to the Medical Subject Heading (MeSH) coding scheme. Virtually every area of medicine has been assigned a MeSH code. By entering one or several codes, you can pinpoint the medical area from which questions will be selected.

MeSH CODES

By every terminal there should be a listing of all valid MeSH codes and their associated subject headings arranged in ascending subject order. There should also be a copy of the Curricular Book, Volume II. The following examples can be verified using the subject order listing.

We shall assume that you want to look at questions about CARDIOLOGY. From the listing, you will find that its MeSH code is G2.403.776.409.163. Note that this is a subset of INTERNAL MEDICINE, MeSH code G2.403.776.409. It in turn is a subset of SPECIALTIES, MEDICAL (MeSH G2.403.776) which is a subset of MEDICINE (MeSH G2.403) which is the first subset of HEALTH OCCUPATIONS (MeSH G2).

All codes work in the same fashion. Short numbers cover broad categories and each additional qualifier points to a more specific subset. There can be up to six quailifiers attached to the first letter/number group so the entire entity is referred to as the "7-level" MeSH code.

MULTIPLE SUBSETS

The testing program is capable of selecting from a unique MeSH code, or that code and all of its subsets. This is done by prefacing the code with a "g-" which tells the program you are using a group code. For example, if you wanted questions on INTERNAL MEDICINE you would use the code G2.403.776.409. However, if you also wanted its subsets (CARDIOLOGY, ENDOCRINOLOGY, GASTROENTEROLOGY, HEMATOLOGY, AND IMMUNOLOGY) you would enter G-G2.403.776.409. This will select all questions with a MeSH of G2.403.776.409 through G2.403.776.409.651. In a similar manner, if "G-G2.403.776" is entered, all subjects under and including MEDICAL SPECIALITIES will be selected. If "G2.403.776" is entered, only questions directly related to SPECIALTIES, MEDICAL will be given.

COMBINING MeSH CODES

There are times when you will want to use more than one MeSH code to retrieve questions from the Item Library. This could be because some subjects are assigned more than one MeSH code or because you need questions in several different subject areas. Perhaps questions are desired covering a very specific area that can not be described with only one MeSH code. Any of these needs can be satisfied through the use of "logical" operators.

Logical Operators

There are three logical operations used to combine MeSH codes. They are as follows:

WORD	SYMBOL
AND	& (ampersand)
OR	| (vertical bar)
NOT	~ (tilde)

The "AND" connotes the intersection of two sets of questions. The "OR" implies the union of two sets, and the "NOT" means the exclusion of a given code.

Here are some examples. If you specify MeSH 1 and MeSH 2 a question will be selected only if it is coded with both the first and second MeSH codes. If you enter MeSH 1 or MeSH 2 questions coded with either code will be selected. Since questions are initially coded with up to 12 MeSH codes, multiple codes may be logically connected.

EXAMPLES:

MeSH 1 and MeSH 2 and MeSH 3

Questions must have all three codes.

MeSH 1 or MeSH 2 or MeSH 3 or MeSH 4

Questions can have any of the four codes.

MeSH 1 and MeSH 2 and MeSH 3.....and MeSH 12

Theoretically possible, but most unlikely. A question would have to have all 12 codes. Adding one more code (MeSH 13) would be an absolute impossibility. However, entering

MeSH 1 or MeSH 2 or MeSH 3......or MeSH 12 or MeSH 13

is quite valid and would probably result in a large number of questions.

Now consider the following:

MeSH 1 and MeSH 2 or MeSH 3

This may appear to state that you want questions having the first two codes and, in addition, any questions with the third code. This is correct. However, what if you wanted questions with MeSH 1 and either MeSH 2 or MeSH 3? There are two ways to do this.

Looking at Volume II of the Curricular Book you will notice the MeSH codes are given for most of the subjects listed. In many cases, two or more codes have been connected with the logical operators. In some instances the above problem has been solved as follows.

MeSH 1 and MeSH 2 or MeSH 1 and MeSH 3

This statement could be interpreted in several different ways. Obviously there must be some logical order the computer follows when deciphering the codes.

Hierarchy

There is indeed a specific order existing that the computer will use when looking at the MeSH codes. The three logical operators plus the parenthesis (discussed shortly) are operated on in the following order.

Hierarchy	Operator
1	( )
2	AND
3	OR
4	NOT

Therefore, the MeSH grouping of

MeSH 1 and MeSH 2 or MeSH 3

is interpreted to mean questions with the first two codes or any other question with the third code because the AND has precedence over the OR.

To override the default hierarchy, the parenthesis may be used. They have absolutely top priority and cause the computer to look at all codes and operators within them first. Therefore:

MeSH 1 and (MeSH 2 or MeSH 3)

completely changes the meaning of the same three codes. It now says that questions are to be retrieved having the first code and either code two or code three. This is equivalent to the ways the codes appear in the Curricular Book:

MeSH 1 and MeSH 2 or MeSH 1 and MeSH 3

It is possible to select a broad category and eliminate certain questions in it with the NOT operator. It is used like this:

```
MeSH 1 and not MeSH 2
```

which says that all questions with the first MeSH code are wanted *except* questions that also contain code 2. It *always* follows an AND operator. It may appear before a MeSH code or before a group of codes in parenthesis:

```
MeSH 1 and not (MeSH 2 or MeSH 3)
```

which states you want questions with the first code only if they do not contain the second or third code.

Normally the Curricular Book will give most of the needed combinations of MeSH codes to pinpoint the medical areas. However, using the alphabetic printout of subjects and their associated MeSH codes, codes can be combined in limitless ways. For example:

```
(MeSH 1 and (MeSH 2 or MeSH 3)) or MeSH 4
```

or even the following:

```
(MeSH 1 and not (MeSH 2 and MeSH 3) and MeSH 4 or
(MeSH 1 and MeSH 3) and not MeSH 5) or (MeSH 6 or
(MeSH 2 and not (MeSH 3 and not (MeSH 7 or MeSH 8))))
```

Perfectly legal, practically useless.

Syntax

There are only a few rules and notes to keep in mind when entering MeSH codes at the terminal. We shall call a MeSH code or combination of two or more codes a "Selection Parameter". Each Selection Parameter ends with a semi-colon (;). There must be a space between codes and logical operators. A space is needed before a left parenthesis but not after. Vice-versa for a right parenthesis. Letters may be upper or lower case and logical operators may be the word itself or its symbol.

All of the following are valid:

```
G-C12.777.419.570.363;
```

```
g-c18.452.297 and G-a5.810;
```

```
g-g2.403.776 & (g2.403.776.671 ¦ g2.403.776.909);
```

```
(g-C21.866.460 and G-e2 or g-c21.866.819 & g-e2 ¦
g-C21.866.460 & g-E4) & ~ (g-c21.866.819 and g-E4);
```

Note: The last example will not fit on one line of the screen.

You may continue to type and have it "wrap-around" to the next line without a problem. It appears to be one single line to the computer even though it is visably broken on the terminal.

SAMPLE TEST PROCEDURE

The following instructions should serve as a guide to show you how the testing procedure works. Questions the program asks are shown and your choices for response will be outlined.

Upon selection of the test program after you log-on, the computer will display

```
INPUT SELECTION PARAMETERS....
:_
```

Here you would enter a valid Selection Parameter (don't forget the semi-colon). The computer will translate the codes into the English equivalent and then display

```
NUMBER OF QUESTIONS AVAILABLE:  x
```

where x is the current number of questions stored in the Item Library. You will then be asked to

```
ENTER NUMBER OF QUESTIONS DESIRED:
```

Enter a number between 1 and x. Be realistic. You will get tired long before the computer does. Pick a number and enter it. The computer will then select a question and display it. After you select an answer you will be told if it is right or wrong and a reference for the question will probably be shown. The terminal will then display

```
CA, TA, OR CTRL-D:  _
```

Refer to "Item Analysis Data" for an explanation of CA or TA. You may hit CTRL-D to get another question or you may type

```
END
```

This will cause the program to terminate the asking of questions and give you your score. If you have answered all of the questions you initially selected, the number right and wrong will be displayed. The program will then start over and ask for another Selection Parameter. You may enter one or type

```
END
```

which will terminate the program. A new "Menu" will be displayed and you may then proceed to another activity.

SEQUENTIAL RETRIEVAL

Questions are normally selected randomly from the Item Library. Every time you sit down for a session at the terminal, questions will come out in a different order, even if the same Selection Parameter is used. This can be changed to a sequential order if you desire so that questions always come out in the same order in ascending Item Number sequence. To do this you can type:

```
NORANDOM
```

after the message INPUT SELECTION PARAMETERS has been displayed. The program will issue the same message again and this time you would enter the MeSH codes desired. To return to random selection, type

```
RANDOM
```

after the INPUT SELECTION PARAMETERS message is given. When the message is displayed again, enter the appropriate codes.

You will note that neither command is followed with a semi-colon.

RETRIEVAL BY ITEM NUMBER

If you have a need to look at a particular question and you know its number, proceed as follows. After the INPUT SELECTION PARAMETERS statement, type

```
ITEM
```

The program will then display

```
ENTER ITEM NUMBER
```

Enter the number desired. If a question does not exist for that number the program will display ITEM UNAVAILABLE and you will have a chance to enter another number.

After the question is displayed and the answer given, you may enter another number or type

```
END
```

This will reset the program to accept valid Selection Parameters.

Neither command should be followed with a semi-colon.

ITEM ANALYSIS

Every question that has appeared on a Profile Examination has been analyzed to see how students and Faculty/Staff answered it. This Item Analysis shows, on a percentage basis, how seven groups of people (Years 1-6 and FAC/STAFF) answered the question.

After you have answered a question and been told if you are right or wrong, you may ask to see the analysis of the question. There are two available. A Current Analysis shows the performance of the question the last time it appeared on an exam. A Total Analysis shows the average response for all exams it has appeared on. To look at the Current Analysis, you would type "CA". Total Analysis is "TA".

If the question is new to the Item Library, its analysis will be all zeros so you will get a message stating "QUESTION HAS NOT BEEN USED". Also, if a question has only been given once, Total and Current Analyses will be the same and a message to that effect will be given.

After looking at one analysis (either "CA" or "TA") you may enter the code for the other one, or simply hit CTRL-D to get the next question. Of course, you could hit CTRL-D after the CORRECT/WRONG message and not get an Item Analysis of the question at all.

USE OF "PAGE" KEYS

It is possible for a question and its answers to be longer than 25 lines (the size of the terminal screen). When this occurs, the top line will disappear each time a new line is added at the bottom. These lines may be retrieved for further study by use of the PAGE key.

To look at any lost lines, press the PREV PAGE key. This will show the first 25 lines that were transmitted. To view the rest of the question at this point, press the NEXT PAGE key. These two keys may be used as often as you wish to look at all of the data. When you are ready to enter your answer, depress the appropriate key to make ANSWER: appear on the screen. Use the keys with arrows to position the cursor to the right of the colon, then enter your answer. From this point, the normal procedure will continue.

CHALLENGES

You may challenge any question which you think has an incorrect answer or is, in your estimation, a poor question (ambiguous, typographical errors, etc.) Print the question if the printer is available or write everything on the screen down on paper. You must include the Item Number which is given for each question. Challenges are reviewed by the Evaluation Council.

Appendix A.2

PROGRAM DESCRIPTIONS

PROGRAM NAMING CONVENTION

Column	Description
1-3	Common Identifier: MED
4	Application Descriptor: C = Control I = Item T = Testing U = Utilities Z = Other & Misc.
5	Mode: B = Batch T = TeleProcessing
6-8	Sequence Number: One to three digits, or one to two digits with alpha suffix

Note: When a program overlaps two different application areas, the output destination shall determine the Application Descriptor.

PROGRAM DESCRIPTIONS C-Series

MEDCT02	A text lister. Reads a standard text file and displays it on the tube. Control functions, which are lines in the text prefaced with a dollar sign, are trapped and passed to "CONTROL" to be acted upon. Returns control to invoking procedure at EOF on text file.

PROGRAM DESCRIPTIONS I-Series

MEDIB01	Clears the index file. Must be run before a new pointer file is built. Written in PL/I.
MEDIB02	Formats the pointer file. Run after IEFBR14 allocates a new area for the file. Written in PL/I.

MEDIB03	Adds items to the item file. Input is keypunched question data. MEDIB06 is run before this job. PL/I.
MEDIB15	SEARCH program - Can be selected on any field in Item Library. Logical MeSH connections. Keywork driven selection and printing. PL/I
MEDIB16	Item Analysis Management. Will Shuffle, combine, or delete IA's should a question be modified. May also update Use-History field.
MEDIB17	Count Questions. Prints total number of questions in the Item Bank, number unused, number of PEPE questions and number of unused PEPE questions.
MEDIB19	Batch MeSH count program. Input is the same as MEDIT05, output are total counts for MeSH and any other given parameters. PL/I
MEDIB20	Modifies the contents of the item record status byte to change the current status of an item. PL/I

PROGRAM DESCRIPTIONS I-Series (T)

MEDIT02	Med. test program. Randomly chooses questions from the item bank according to MeSH codes the student gives and presents them to the student for his answer. Keeps track of his performance and displays it at the end of each test.
MEDIT03	Item Bank update program. Updates Question and answers from CRT. Key is by item number. Record is re-written after all desired changes are made.
MEDIT04	Displays the Pointer file control record. Includes the number of active questions on the file.
MEDIT05	On line MeSH count. Input is a MeSH equation which is used to determine a count of the items fitting that equation.
MEDIT09	Displays the ISAM Source file. Will display either a unique source or the entire file, 20 lines at a time.

PROGRAM DESCRIPTIONS T-Series

MEDTB01	Reads optical scanner cards and converts responses to 1-5 responses. Merge all cards per sheet (usually four) into one record which is written on disk. Disk file will be input for MEDTB02. PL/I

MEDTB02	Reads file created by MEDTB01 after sorting by student I.D. number. Combines all sheet records and scores the test. Creates two disk files used for reporting. PL/I.
MEDTB03	Creates scoring list by unit, location code or I.D. number. Lists percentage correct, population and peer standard scores and tables showing mean and standard deviation. PL/I.
MEDTB04	Creates Item Analysis list and tape for input to MEDIB07. PL/I.
MEDTB05	Statistical analysis of test. Performs Kuder-Richardson and other tests on the exam. PL/I.

PROGRAM DESCRIPTIONS U-Series

MEDUB01	Back-up the Item File. Output is tape X00720. PL/I.
MEDUB02	Restore the Item File. Input is tape X00720. Output is new USER.X2394.ITEMFILE.
MEDUB04	Display Index/Pointer chain. Input is one or more cards, each containing one MeSH code beginning in column one, the pointer master, index record and pointer records are displayed for each MeSH.

SUBROUTINES Non-Standard Names

CONTROL	Controls all beehive CRT terminal such as clear screen, reverse video, keyboard disable, etc. Argument is a varying length character string with a dollar sign as the first character. PL/I.
DECODE	Takes the internal MeSH code format and converts it to external format. PL/I.
DEMESH	De-connects an item record from a MeSH code by altering the contents of the appropriate index/pointer chain. PL/I.
ENCODE	Takes the external MeSH code format and converts it to internal format. PL/I.
ENMESH	Connects an item record and a MeSH code by altering the contents of the appropriate index/pointer chain. PL/I.
HEXC	Converts char to hex (used for status byte translation) BAL

KEYPARS	Performs keyword parsing of input. BAL
LINESIZ	Takes a PL/I external print file and returns the current line size.
PLIGTSZ	Returns the current line size of a TSO CRT.
PLIPTSZ	Defines the current line size of a TSO CRT.
PLITERM	Returns the terminal device type name of a TSO CRT. BAL
PLITGET	Allows terminal reads without allocation of a file name to the terminal. BAL
PLITPUT	Allows terminal writes without allocation of a file name to the terminal. Gives the programmer more control of the TSO CRT. BAL
PLUIUSER	Returns the TSO user ID. BAL
PUTITEM	Takes an item record and a parameter list structure and displays it in standard format. If Putitem is instructed to write to the printer, the DDNAME report is used. If Putitem is instructed to write to the CRT, full screen writing and editing capabilities are employed. PL/I.
QPEDATE	Takes the Profile Examination number and returns char(11) var date. PL/I.
QPENMBR	Takes the Profile Examination date and returns the fixed bin Profile Examination number. PL/I.
RANDOM	Random number generator. Takes seed and returns a real and fixed random number. PL/I.

Appendix A.3

SEARCH USER'S GUIDE

INTRODUCTION

MEDIB15 is a computer program designed and written for the University of Missouri-Kansas City School of Medicine. Its function is the search, logical selection and output of questions and data found in the Test Question Item Library.

The questions selected by MEDIB15 are determined by instructions supplied to the program by the user. These instructions may explicitly define the questions to be selected, implicitly define the questions to be selected (for example, the selection of random questions from a specific category), and/or determine the data to be printed from those records selected.

In addition, MEDIB15 can process multiple requests for questions (multiple sets of instructions) in a single execution of the program. It should be noted that no question will ever be selected more than once during a single program run, regardless of the number of requests for questions, unless explicitly instructed to do so, making the program an especially powerful tool for the construction of tests.

Since the user must supply MEDIB15 with instructions, it is important that these instructions be syntactically and logically correct if the user is to receive the output desired. Errors waste time, effort and money. Succeeding pages of this manual explain how to use this program. It should be read and understood to use MEDIB15 efficiently.

JOB CONTROL LANGUAGE REQUIREMENTS

MEDIB15 and the files it uses are maintained with the University of Missouri Computer Network. This computer system requires the user to define:

1) the program to be run,

2) the files to be used by that program and

3) the user input to the program (the instructions MEDIB15 uses when selecting questions.)

This is accomplished with IBM's Job Control Language or JCL. Some of the JCL required to run MEDIB15 has been saved in a "procedure" library at University of Missouri Computer Network. By using the following JCL, the user can instruct the system to combine the library JCL with his own, shortcutting the time spent keypunching and correcting keypunch errors:

```
//MEDIB15 JOB (2394KM,MDP,512,9999),'ITEM LIBRARY SEARCH'
//EXEC SEARCH
//SEARCH.SYSIN DD *
     user input to MEDIB15 is placed here
/*
//
```

The JCL required when not using the procedure library is listed below:

```
//MEDIB15 JOB (2394KM,MDP,512,9999),'ITEM LIBRARY SEARCH'
//SEARCH EXEC PGM=MEDIB15
//STEPLIB DD DSN=USER.X2394.LIB,DISP=SHR
//ITEM DD DSN=USER.X2394.ITEMFILE,DISP=SHR
//POINTER DD DSN=USER.X2394.POINTER,DISP=SHR
//INDEX DD DSN=USER.X2394.INDEX,DISP=SHR
//SORCE DD DSN=USER.X2394.SOURCE.FILE,DISP=SHR
//INFO DD DSN=USER.X2394.PEPEINFO,DISP=SHR
//SYSPRINT DD SYSOUT=A
//REPORT DD SYSOUT=A
//PLIDUMP DD SYSOUT=A
//SYSPNCH DD SYSOUT=B
//SYSIN DD *
     user input to MEDIB15 is placed here
/*
//
```

Regardless of which method is used, there are certain options that the user may wish to employ or suppress. SUPPLYING PARAMETERS and SPECIFYING SPECIAL FORMS require modifications to the above JCL.

SUPPLYING PARAMETERS

PARAMETERS are user-defined values and options supplied to the program being run via the PARM keyword of the EXEC statement in the user's JCL. To supply parameters when using user/library JCL, the EXEC statement should be modified to:

```
//EXEC SEARCH,PARM.SEARCH='/parameters'
```

To supply parameters when not using library JCL, the EXEC statement should be modified to:

```
//SEARCH EXEC PGM=MEDIB15, PARM='/parameters'
```

Examples:

```
//EXEC SEARCH,PARM.SEARCH='/OPTIMIZE'
//SEARCH EXEC PGM=MEDIB15,PARM='/COLUMNS=(1,80),RUN'
```

SPECIFYING SPECIAL FORMS

It may occasionally be desirable to have the questions selected and printed by MEDIB15 to be printed on paper other than the standard green-bar stock used in most installations. This is accomplished with the REPORT DD statement. To specify special forms when using user/library JCL, the following card should be inserted immediately following the EXEC statement:

```
//SEARCH.REPORT DD SYSOUT=(J,,form name)
```

To specify special forms when not using library JCL, the REPORT DD statement should be modified to:

```
//REPORT DD SYSOUT=(J,,form name)
```

Examples (WW1 is the form name for WHITE):

```
//SEARCH.REPORT DD SYSOUT=(J,,WW1)
//REPORT DD SYSOUT=(J,,WW1)
```

PARAMETERS

MEDIB15 employs parameters to allow user control of certain execution time options. The parameters take the form of keywords optionally followed by data and separated from other keywords by commas. The first character of this 'keyword-list' must be a slash and the length may never exceed one hundred characters. Each parameter is discussed in detail below.

THE COLUMNS KEYWORD

The COLUMNS keyword allows the user to define that portion of each user input card in which MEDIB15 will find valid user selection statements. The COLUMNS keyword can be abbreviated to COL if the user desires. This keyword takes the form:

```
COLUMNS = (first column, last column)

  or

COL = (first column, last column)
```

Neither 'first column' nor 'last column' may be less than one or greater than eighty and 'first column' must be less than or equal to 'last column'. These two values define the range of card columns that will be scanned for selection statements. Data not appearing within this range is ignored. If this keyword is omitted, the program defaults to the entire card:

```
COLUMNS = ( 1,80)
```

THE OPTIMIZE AND NOOPTIMIZE KEYWORDS

The OPTIMIZE and NOOPTIMIZE keywords are mutually exclusive and can be abbreviated to OPT and NOOPT, respectively.

The OPTIMIZE keyword instructs MEDIB15 to:

Create and maintain a list of MeSH codes and the items associated with each.

Compare each MeSH encountered with the list of those previoulsy encountered, and if a match is found, use the results of that previous search rather than instigate a new search.

The NOOPTIMIZE keyword implies that the creation and maintaining of a list of MeSH codes encountered and associated items and comparisons of each new MeSH code with that list is a needless task because no duplicate MeSH codes will be found.

If OPTIMIZE and NOOPTIMIZE are omitted, the default is OPTIMIZE.

THE RUN AND NORUN KEYWORDS

The RUN and NORUN keywords are mutually exclusive. The RUN keyword instructs MEDIB15 to perform any searching necessary to satisfy any request unless errors are detected that prevent such searching. The NORUN keyword specifies that all program functions are to be performed except the search. NORUN is useful when a user wishes to check input for errors before attempting to run a full search. When RUN and NORUN are omitted, the default is RUN.

PARAMETER USAGE EXAMPLES

```
/COLUMNS=(1,72),NORUN,NOOPT
/RUN,OPTIMIZE
/COL = ( 2, 72 ),OPT
/NOOPTIMIZE
```

PROGRAM INPUT

The syntax, logic and keywords for user program input will be described in the following pages.

SYNTAX

The building block with which all user input is composed is the KEYWORD. MEDIB15 has approximately two dozen keywords at your disposal. Each of these keywords specifies some program function to be performed and identifies the information appearing with it:

```
KEYWORD = information
```

Often, more than one keyword must be used to obtain the desired results. When this is the case, each keyword is separated from surrounding keywords by a comma:

```
KEYWORD = information, KEYWORD = information, . . .
```

A collection of related keywords is termed a REQUEST (REQUESTS are discussed in detail in the next section: LOGIC.) The last keyword in a request is always followed by a semicolon:

```
..., KEYWORD = information;
```

The information appearing with a keyword can be in many forms. It may be a single value, such as a date, or a string of values, such as a list of item numbers. A string of values appearing with a keyword are separated by at least one blank space:

```
KEYWORD = value value value
```

These values may be enclosed in parentheses for readability, if you wish:

```
KEYWORD = (value value value)
```

If you enclose values in parentheses, you may also separate values with commas:

```
KEYWORD = (value,value,value)
```

Two values can be joined by the word "TO" or a colon to indicate a range of values. The word "TO" must be preceded and followed by a blank but no restriction is placed on the colon:

```
value TO value       or      value:value
```

A value or a range of values may be preceded by the word "NOT" or the not sign to indicate the negation of the value or the range of values. The word "NOT" must be followed by at least one blank. The word "NOT" and the not sign cannot be embedded within a range of values:

```
NOT value                  ¬ value

NOT value TO value         ¬ value TO value

NOT value:value            ¬ value:value
```

When a value contains an equal sign, a parenthesis, a comma, a semicolon, a blank, a colon, a not sign, or the character strings " TO " or " NOT " and these characters are intended to be information rather than delimeters or operators, that value can be made a literal expression by enclosing it within quotes:

```
"=(),:NOT TO ¬:"
```

When a literal value must contain quotes, two quotes are required to represent one embedded quote:

```
"=(),;""NOT""""TO""¬:"
```

When a value contains an equal sign, a parenthesis, a comma, or a semicolon, all the values appearing with that keyword are enclosed within parentheses:

```
KEYWORD = ("=(),;" value value)
```

Keywords may begin anywhere on a card. When it becomes necessary to continue on a new card, simply continue where you left off. There is a limit placed on the number of cards that MEDIB15 can accept. The equation (see section PARAMETERS, THE COLUMNS KEYWORD) that is used for figuring this number is given below:

```
total cards = (32767 - MOD (32767, last column - first column
                  + 1)) / (last column - first column + 1)
```

If the COLUMNS parameter were: COLUMNS = (1,80) then by the equation above, a total of 409 cards can be supplied.

LOGIC

The technique used to select items from the Item Library is to describe the characteristics of the items you want by using the keywords at your disposal. The values appearing with a keyword normally describes one of the possible characteristics:

```
EXAM=FEB74
```

The above statement would cause all items that appeared on the February 1974 Profile Examination to be selected. When more than one value is supplied with a keyword, an implied 'OR' exists between each:

```
EXAM=FEB74 AUG76
```

This statement would cause all items that had appeared on the February 1974 Profile Examination OR on the August 1976 Profile Examination to be selected. When a value is preceded by the word "NOT" or the not sign, the implied 'OR' becomes an implied 'AND':

```
EXAM=FEB74 AUG76 NOT MAY72
```

This statement would cause all items that had appeared on the February 1974 Profile Examination OR on the August 1976 Profile Examination AND which had NOT appeared on the May 1972 Profile Examination to be selected. When two occurrences of a single keyword are encountered, MEDIB15 will combine them using the rules discussed above:

```
EXAM=FEB74,EXAM=AUG76 NOT MAY72
```

is identical to:

```
EXAM+FEB74 AUG76 NOT MAY72
```

When two or more unlike keywords are supplied, an implied 'AND' exists between each:

```
EXAM=FEB74, DATEIN=JAN72
```

This statement would cause all items that had appeared on the February 1974 Profile Examination AND which were submitted to the Item Library in January 1972 to be selected.

A REQUEST is a collection of one or more keywords, delimited by commas and ended with a semicolon. All the keywords in a REQUEST are logically dependent upon one another, defining that 'set' of items in the Item Library you desire.

Unlike keywords within a request, requests are not logically dependent upon one another. However, several related requests, such as might be required for test generation, can be combined into a GROUP. There are never duplicate item selections by requests in the same group. No such check is made, however, with requests in different groups.

MEDIB15 considers all request to be members of the same group unless specifically instructed otherwise by the GROUP keyword.

Below is a list of the keywords recognized by MEDIB15 along with a brief explanation of each. Each keyword has an abbreviated form, called an alias, which can be used. For a detailed description of a particular keyword, see the section titled with that keyword.

KEYWORD	ALIAS	DESCRIPTION
ANSWERS	ANS	SELECTION BY CONTENTS OF ITEM ANSWERS TEXT
DATEIN	D	SELECTION BY DATE SUBMITTED TO ITEM LIBRARY
EXAM	E	SELECTION BY PROFILE EXAMINATION DATES
GROUP	G	DEFINES A NEW GROUP

Continued

KEYWORD	ALIAS	DESCRIPTION
IA	IA	SELECTION BY TOTAL PROFILE EXAMINATION ITEM ANALYSIS
ITEM	I	EXPLICIT SELECTION BY ITEM NUMBER
MESH	M	SELECTION BY MeSH CODES
NEED	N	DEFINE THE NUMBER OF ITEMS TO BE SELECTED
ORDER	O	DEFINE THE ORDER THAT ITEMS WILL BE PRINTED
PEPEEXAM	PE	SELECTION BY PEPE EXAMINATION NUMBER
PEPEIA	PIA	SELECTION BY PEPE ITEM ANALYSIS
PEPEUSAGE	PU	SELECTION BY PEPE EXAMINATION USAGE
PRINT	PR	DEFINE THE PORTIONS OF EACH ITEM TO PRINT
QUESTION	Q	SELECT BY CONTENTS OF ITEM QUESTION TEXT
RANGE	R	IMPLICIT SELECTION BY ITEM NUMBER
REFERENCE	REF	SELECTION BY ITEM REFERENCE TEXT
REVIEWED	RVD	SELECTION BY LAST REVIEW DATE
REVIEWER	RVR	SELECTION BY LAST REVIEWER CODE
SOURCE	SO	SELECTION BY SOURCE CODE
STATUS	ST	SELECTION BY ITEM STATUS
UPDATE	UP	SELECTION BY LAST UPDATE DATE
USAGE	U	SELECTION BY PROFILE EXAMINATION USAGE

THE ANSWERS KEYWORD

ALIAS: ANS

FUNCTION:
The ANSWERS keyword is used for inspection of the answers text of an item record.

FORMAT:
The value is a string of one to seventy-two characters.

Any number of values can be supplied

Ranges of values are not allowed

The NOT operator is valid

SELECTION:

The answers text of the item record is scanned for a string of characters identical to one of the values supplied.

EXAMPLES:

```
ANSWERS=NIACIN
ANS=NOT "NONE OF THE ABOVE"
ANSWERS=DEXTROAMPHETAMINE PICROTOXIN STRYCHNINE
ANS=("O NEG; " "1,2 AND 3")
```

THE DATEIN KEYWORD

ALIAS: D

FUNCTION:

The DATEIN keyword is used for inspection of the date an item record was submitted to the Item Library.

FORMAT:

The value is a five character date composed of the first three letters of any month followed by the last two digits of any year.

Any number of values can be supplied.

Range and Not operations are valid.

SELECTION:

The submit date of the item record is compared for equality with a single value or within the bounds of a range of values.

EXAMPLES:

```
DATEIN=JAN72 FEB73
D=(MAR74:APR77,NOT JUN75 ¬ JUL76)
```

THE EXAM KEYWORD

ALIAS: E

FUNCTION:

The EXAM keyword is used for inspection of the dates an item record has appeared on the Profile Examination.

FORMAT:

The value is a five character date composed of the first three characters of any of the four months a year the Profile Examination is administered (FEB, MAY, AUG, NOV) followed by the last two digits of any year.

Any number of values can be supplied.

Range and Not operations are valid.

SELECTION:
The examination dates of the item record are compared for equality with a single value or within the bound of a range of values.

EXAMPLES:

```
EXAM=FEB77
E=(MAY72:NOV76, AUG76)
```

THE GROUP KEYWORD

ALIAS: G

FUNCTION:
The GROUP keyword signals that the request in which it appears along with all requests following it (until a new GROUP keyword is encountered) are to be considered in a new group. (See section ITEM SELECTION, LOGIC)

FORMAT:
N/A

SELECTION:
N/A

EXAMPLES:

```
...GROUP,...
```

THE IA KEYWORD

ALIAS: IA

FUNCTION:
The IA keyword is used for inspection of the Profile Examination total item analysis data.

FORMAT:
The value is composed of a real number greater than or equal to zero and less than or equal to one hundred, followed by a slash and one of the seven options

YR1 YR2 YR3 YR4 YR5 YR6 FCTY

Any number of values can be supplied.

When constructing a range, the range is established between the two real numbers. The slash and option must follow the two real numbers.

The Not operation is valid.

SELECTION:

The Profile Examination item analysis data is converted to percentages and then compared for equality with a single or within the bounds of a real number range in the category identified by the option following the slash.

EXAMPLES:

```
IA=50/YR1
IA=55.25 TO 100/YR3
IA=NOT 0:50/YR1¬ 0:50/YR2 NOT 0 TO 50/YR3
IA=0 TO 50/FCTY
```

THE ITEM KEYWORD

ALIAS: I

FUNCTION:

The ITEM keyword allows the user to explicitly select items by item number.

FORMAT:

The value is any integer number greater than zero and less than 32,767. The Item Library may contain less than 32,767 items. Care should be taken that an invalid item number is not supplied.

Any number of values can be supplied.

Ranges and Not operations are valid.

SELECTION:

If an item record exists with a key equal to a value or within the bounds of a range, it is selected.

EXAMPLES:

```
ITEM=2099
I=(1:500 1000:1500)
ITEM=1 2 3 4 5 6 7 8 9
I=1:500¬ 99:409
```

THE MESH KEYWORD

ALIAS: M

FUNCTION:

The MeSH keyword allows searching by Medical Subject Heading Codes or MeSH codes. This type of search does not cause an Item Library search to be instigated.

FORMAT:

The value is the MeSH Code. A MeSH Code is composed of a letter followed by one to seven values each separated by a period, each value consisting of one to three numeric digits. Each MeSH Code identifies a particular subject or category into which an item may be placed. An item may contain up to fifteen MeSH Codes:

```
G2.403.776.409
N2.350.84
C18.452.648.618.337
E2.319
```

MeSH Codes can be combined using the Boolean operators:

```
"AND"   &   E2.319 AND N2.350.84
"OR"        C18.452.648.337 OR G2.403.776.409
"NOT"       NOT N2.350.84
```

If the word forms are used, "AND" and "OR" must be preceded by a blank, "AND", "OR" and "NOT" must be followed by a blank. No restrictions are placed on the corresponding symbols.

MeSH Codes may also be nested with parentheses. As many as ten levels of nesting may be employed:

```
G1.703   (D20.85.467.352 & ( B4.909.777  E1.223))
```

A fourth operation is also available. The generic function, indicated by the characters "G-", causes all sublevels of a given MeSH Code to be included:

```
G-G1  is equivalent to  G1.100  G1.100.520  ...
```

The above statement causes all MeSH Codes which begin "G1" to be included and combined by an "OR".

Ranges are not allowed. Only one MeSH statement is allowed per request.

EXAMPLES:

```
MESH=G-G1.703 OR G2.403.776.671
M=((D20.85.312&C19.246&N2.350.84)  G-E2.319 A1.378.592)&G-G1.100
MESH=G-G2  G-G3
```

THE NEED KEYWORD

ALAIS: N

FUNCTION:

The NEED keyword informs MEDIB15 how many items must be selected.

FORMAT:

The value is an integer greater than zero and less than 32,767.

Only one value is supplied.

Range and Not operations are not allowed.

SELECTION:

If more items are selected than are NEEDed, the excess items are eliminated. If less items are selected than are NEEDed, the request is given priority (in duplicate selection elimination) over requests which have more items selected than they need or have a greater percentage than the current request.

EXAMPLE:

```
NEED=1
N=20000
```

THE ORDER KEYWORD

ALIAS: O

FUNCTION:

The ORDER keyword is used to specify the order in which items are to be selected and printed.

FORMAT:

One of these three options:

1) SEQUENTIAL (alias S) - item number ascending

2) DESCENDING (alias D) - item number descending

3) RANDOM (alias R) - randomly

The Range and Not operations are not allowed.

SELECTION:

Selection and printing are performed for the request in one of the three orders described above. Any number of requests may specify any order. If ORDER is not used, the default is SEQUENTIAL.

EXAMPLES:

```
ORDER=RANDOM
O=DESCENDING
ORDER=S
O=R
```

THE PEPEEXAM KEYWORD

ALIAS: PE

FUNCTION:
The PEPEEXAM keyword is used for inspection of the dates an item record has appeared on a Profile Examination for Physician Extenders examination.

FORMAT:
The value is an integer number greater than zero which corresponds to PEPE examination number.

Any number of values can be supplied.

Range and Not operations are valid.

SELECTION:
The PEPE examination history of the item record scanned for PEPE examination numbers equal to a single value or within the bounds of a range of values.

EXAMPLES:

```
PEPEEXAM=(1,3,5)
PE= 1 3 5
PEPEEXAM=1:4¬2
```

THE PEPEIA KEYWORD

ALIAS: PIA

FUNCTION:
The PEPEIA keyword is used for inspection of the PEPE examination item analysis data.

FORMAT:
The value is composed of a real number greater than or equal to zero and less than or equal to one hundred, followed by a slash and one of the nine options

PRE MID POST MED OCCU PHY RES RAD DIA

Any number of values can be supplied.

When constructing a range, the range is established between the two real numbers. The slash and option must follow the two real numbers.

The Not operation is valid.

SELECTION:

The PEPE item analysis data is converted to percentages and then compared with the real number value for equality or within the bounds of a real number range in the category identified by the option following the slash.

EXAMPLES:

```
PEPEIA=32.33/OCCU
PIA=50.75/PRE 50:75/MID 50:75/POST
PEPEIA=¬0:66.667/PHY
```

THE PEPEUSAGE KEYWORD

ALIAS: PU

FUNCTION:

The PEPEUSAGE keyword is used for inspection of the number of PEPE examinations for which an item has been used.

FORMAT:

The value is an integer number greater than zero which corresponds to a count of PEPE examinations.

Any number of values can be supplied.

Ranges and Not operations are valid.

SELECTION:

The number of PEPE examinations on which the item has appeared is compared with a single value for equality or with a range of values for within bounds.

EXAMPLES:

```
PEPEUSAGE=NOT 0
PU=1:3 5
PEPEUSAGE=¬1
```

THE PRINT KEYWORD

ALIAS: PR

FUNCTION:

The PRINT keyword allows the user to specify those portions of the selected item records to be printed.

FORMAT:

ANY of the following options.

OPTION	ALIAS	DESCRIPTION
STATUS	ST	print the status byte
QUESTION	Q	print the question text
ANSWERS	ANS	print the answers text
CORRECT	C	print or flag the correct answer
REFERENCE	REF	print the reference text
SOURCECODE	SOC	print the source code only
SOURCETEXT	SOT	print the source text only
SOURCE	SO	print the source code and text
SUBJECT	SU	print the Medical Subject Headings
MESH	M	print the MeSH Codes
DATEIN	D	print the date submitted
UPDATE	UP	print the last update date
REVIEWED	RVD	print the last review date
REVIEWERCODE	RVRD	print the last reviewer code only
REVIEWERTEXT	RVRT	print the last reviewer text only
REVIEWER	RVR	print the last reviewer code and text
LASTNO	L	print the last Profile Examination question number
EXAMS	E	print the Profile Examination dates
LASTANAL	LA	print the Profile Examination last analysis
TOTALANAL	TA	print the Profile Examination total analysis
ANAL	A	combine and print Profile Examination last and total analysis
LASTANALRAW	LAR	print the raw Profile Examination last analysis
TOTALANALRAW	RAT	print the raw Profile Examination total analysis
ANALRAW	AR	combine and print raw Profile Examination last and total analysis
PEPEEXAMS	PE	print the PEPE examinations
PEPEINFO	PI	print the PEPE examinations detail
PEPEANAL	PA	print the PEPE analysis
PEPEANALRAW	PAR	print the raw PEPE analysis
DIAGNOSTIC	DIAG	print items in diagnostic format
ITEM	I	print the item number
SEQ	SEQ	sequence number each item (if QUESTION)*
NEWPAGE	NP	begin each item on a new page
FULLPAGE	FP	place each item fully on one page
PAGE	PAGE	page number each page*

*An initial value may be supplied with these keywords which will over-ride the default value of 1.

Any number of options may be supplied.

The SEQ and PAGE options may optionally be supplied with a starter sequence of page number:

SEQ:sequence number

PAGE:page number

In addition to the previous options, five other options are available:

OPTION	ALIAS	DESCRIPTION
TEST	TEST	specifies: SEQ,FULLPAGE,QUESTION,ANSWERS, REFERENCE,PAGE
DEFAULT	DEF	specifies: SEQ,ITEM,NEWPAGE,PAGE,QUESTION, ANSWERS,CORRECT,REFERENCE,SOURCE,SUBJECT, MESH,DATEIN,UPDATE,REVIEWED,REVIEWER,ANAL, LASTNO,EXAMS,PEPEEXAMS,PEPEANAL
ALL	ALL	specifies: DIAGNOSTIC,ITEM,SEQ,NEWPAGE, PAGE,STATUS,QUESTION,ANSWERS,CORRECT, REFERENCE,SOURCE,SUBJECT,MESH,DATEIN, UPDATE,REVIEWED,REVIEWER,LASTNO,EXAMS LASTANAL,TOTALANAL,ANAL,ANALRAW,PEPEEXAMS, PEPEINFO,PEPEANAL,PEPEANALRAW
NOTHING	NO	specifies that nothing will be printed
SETDEFAULT	SETDEF	modifies the options implied by the DEFAULT keyword to those options appearing with this option

Ranges are not allowed.

Not operations are valid.

EXAMPLES:

```
PRINT=(Q,ANS,C,LA,TA,LAR,TAR)
PR=SETDEF TEST ITEM
PRINT=(ITEM REF A AR SU)
```

THE QUESTION KEYWORD

ALIAS: Q

FUNCTION:
The QUESTION keyword is used for inspection of the question text of an item record.

FORMAT:
The value is a string of one to seventy-two characters

Any number of values can be supplied

Ranges of values are not allowed

The NOT operator is valid

SELECTION:

The question text of the item record is scanned for a string of characters identical to one of the values supplied.

EXAMPLES:

```
QUESTION="ALL OF THE FOLLOWING EXCEPT:"
Q=¬?
QUESTION=DIPHENOXYLATE/  PENICILLINASE-PRODUCING
Q=NOT "IN""ASEPTIC""MENINGITIS"
```

THE RANGE KEYWORD

ALIAS: R

FUNCTION:

The RANGE keyword allows the user to specify which items in the Item Library will be searched with the available item search keywords.

FORMAT:

The value is any integer number greater than zero and less than 32,767. The Item Library may contain less than 32,767 items. Care should be taken that invalid item number is not supplied.

Any number of values can be supplied.

Ranges and Not operations are valid.

SELECTION:

If an item record exists with a key equal to a value or within the bounds of a value range, it will be selected to be searched by the item search keywords or ignored if specified by a NOT.

EXAMPLES:

```
RANGE=1 TO 1000
RANGE=1 TO 5000 NOT 3647:3811
R= 1 3 5 7
```

THE REFERENCE KEYWORD

ALIAS: REF

FUNCTION:

The REFERENCE keyword is used for inspection of the reference text of an item record.

FORMAT:

The value is a string of one to seventy-two characters

Any number of values can be supplied

Ranges of values are not allowed

The NOT operation is valid

SELECTION:

The reference text of the item record is scanned for a string of characters identical to one of the values supplied.

EXAMPLES:

```
REFERENCE="GUYTON A. TEXTBOOK OF PHYSIOLOGY"
REF=("ENCE; "GYNECOLOGY)
REFERENCE=ANATOMY NOT SYNOPSIS
```

THE REVIEWED KEYWORD

ALIAS: RVD

FUNCTION:

The REVIEWED keyword is used for inspection of the review date (of the last review) of an item record.

FORMAT:

The value is a five character date composed of the first three characters of any month followed by the last two digits of any year.

Any number of values can be supplied.

Range and Not operations are valid.

SELECTION:

The last review date is compared for equality with a single value or within the bounds of a range of values.

EXAMPLES:

```
REVIEWED=APR76
RVD=MAR76:APR77
REVIEWED = (MAR73 TO APR73  NOT SEP75 MAY74:JUN76)
```

THE REVIEWER KEYWORD

ALIAS: RVR

FUNCTION:

The REVIEWER keyword is used for inspection of the reviewer code (for the last review) of an item record.

FORMAT:

The value is an integer number greater than zero which corresponds to the reviewer code.

Any number of values can be specified.

Range and Not operations are valid.

SELECTION:

The last reviewer code is compared for equality with a single value or within bounds of a range of values.

EXAMPLES:

```
REVIEWER = 999
RVR=1 17 19:21 200
REVIEWER=(1 TO 50,¬17:23)
```

THE SOURCE KEYWORD

ALIAS: SO

FUNCTION:

The SOURCE keyword is used for inspection of the source code of the item record.

FORMAT:

The value is an integer number greater than zero which corresponds to a source code.

Any number of values can be specified.

Range and Not operations are valid.

SELECTION:

The source code is compared with a single value or within the bounds of a range of values.

EXAMPLES:

```
SOURCE=87 198
SO = (1 TO 32 36 TO 39)
SOURCE=NOT 18:44
```

THE STATUS KEYWORD

ALIAS: ST

FUNCTION:
The STATUS keyword is used for inspection of the item record status byte.

FORMAT:
The value is a character. Any of the 256 EBCDIC characters can be used.

Any number of values can be specified.

Range and Not operations are valid.

SELECTION:
The status byte of the item record is compared for equality with a single value or within the bounds of a range of values.

EXAMPLES:

```
STATUS=D
ST=(" " TO D,E,T)
```

THE UPDATE KEYWORD

ALIAS: UP

FUNCTION:
The UPDATE keyword is used for inspection of the last update date of an item record.

FORMAT:
The value is a date in MM/DD/YY format.

Any number of values can be supplied.

Range and Not operations can be performed.

SELECTION:
The last update date of an item record is compared for equality with a single value or within the bounds of a range of values.

EXAMPLES:

```
UPDATE=10/14/76
UP=8/13/76 TO 8/19/76 NOT 8/16/76
UPDATE=10/14/76
```

THE USAGE KEYWORD

ALIAS: U

FUNCTION:

The USAGE keyword is used for inspection of the number of Profile Examinations for which an item has been used.

FORMAT:

The value is an integer number greater than zero which corresponds to a count of Profile Examinations.

Any number of values can be used.

Range and Not operations are valid.

SELECTION:

The number of Profile Examinations on which the item has appeared is compared with a single value for equality or within the bounds of a range of values.

EXAMPLES:

```
USAGE= 2 4 6
U=(1 TO 2)
USAGE=(1,3,4,6,7)
U=NOT 1 TO 2
```

Appendix A.4

REPLICATION CONSIDERATIONS

The current PEPE testing system is running on an IBM 370/168 computer under OS/MVS and TSO. It is almost mandatory that the system be used with a machine with similar capabilities. Fortunately, this configuration is not uncommon and any user should be able to find such a hardware/software combination. (The National Library of Medicine, for one, has such a system.)

The majority of the system is written in PL/I and would thus run on any system with such a compiler (Honeywell, CDC, etc.). Changes would have to be made to any Assembler routines to match the given hardware. Another time-sharing system besides TSO may also work for the updating and on-line testing function. The Curricular Matrix utilized MARK IV which is available on many machines.

The physical storage medium for the ITEMFILE is an IBM 3350 disk pack. The record size was partially determined by this fact. Five records are stored on each track and parameters currently indicate 20,000 questions which would require 4,000 3350 tracks. If the file is stored on a 3330, the PL/I structure should be redone, adjusting the amount of reserved area, so that a full track will be used. With a change of record size, three records per track may be stored on a 3330.

The INDEX and POINTER files reside on a 3330 and take 152 and 369 tracks respectively. With this allocation, there are 14,000 pointer records, which appear to be quite adequate to connect 20,000 questions. The INDEX file size need not be changed unless NLM greatly increases the number of MeSH codes.

All load modules used in the system reside in a Partitioned Data Set (PDS) and all source programs are in another PDS. The load PDS requires about 400 3330 tracks, the source takes around 150 tracks.

The files are available on one tape. To generate the system on another machine would require using an IBM utility to restore the unloaded load module PDS. The programs in this dataset would then restore the Item Library and INDEX file. CONNECT program (MEDIB04) would be run which would link the files together.

If the software being used is not OS/MVS Rel. 3.7, it is possible that the load modules will not work and must be regenerated. In this case, restore the source PDS file from the tape instead of the load PDS and recompile the programs. The rest of the system generation would then continue as stated above.

Anyone wishing to replicate this system should contact the Computer Center at the UMKC School of Medicine, Kansas City, Missouri. Arrangements will be made at that time to furnish all machine readable information and relevant documentation.

APPENDIX B

SELECTED BIBLIOGRAPHY

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COMPUTERIZED CURRICULAR MATRIX

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PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE		SHEPPARD	
		HRS	PCT	HRS	PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	96.0	6.4	382.2	16.8
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	3.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	37.0		77.0	
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	5.0		25.0	
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	3.5		16.0	
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	10.0		37.0	
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	11.0		34.6	
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	4.0		25.0	
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	8.5		71.6	
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	2.0		34.0	
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	1.0		25.0	
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	1.0		9.0	
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75	5.0			
MICROBIOLOGY G-G1.273.540	536	36.4	2.4	79.6	3.5
BACTERIA G-B3 AND G-G1.273.540	301	14.9		43.0	
VIRUSES G-B4 AND G-G1.273.540	85	5.0		3.0	
RICKETTSIA G-B3.542.651 AND G-G1.273.540	9	1.5		1.0	
FUNGI G-B5.354 AND G-G1.273.540	20	5.0		5.3	
COMMON PARASITES G-B1 AND G-G1.273.540	13	1.0		7.3	
BACTERIOLOGICAL TECHNIQUES G-E5.909.123 OR G-D26.342	41	9.0		20.0	

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
PHARMACOLOGY G-G1.703 OR G-G2.628 OR G-G12.	1139	58.0	3.8	106.8	4.7
GENERAL PHARMACOLOGY G-G12.	128	5.0		16.0	
TOXICOLOGY G-C21.613.276 OR G1.703.795 OR G2.628.795	375	3.0			
DRUGS ACTING PRIMARILY ON THE CENTRAL NERVOUS SYSTEM (G-D15. OR G-D14) AND G-G1.703	221	10.0		23.8	
DRUGS ACTING PRIMARILY ON THE PERIPHERAL NERVOUS SYSTEM (G-D16. OR G-D17) AND G-G1.703	132	10.0		21.0	
DRUGS ACTING PRIMARILY ON THE CARDIOVASCULAR SYSTEM G-D18. AND G-G1.703	102	6.0		14.0	
HEMATOLOGIC AGENTS G-D19.461 AND G-G1.703	37	4.0			
RENAL AGENTS G-D19.770 AND G-G1.703	55	1.0		7.0	
GASTROINTESTINAL AGENTS G-D19.316 AND G-G1.703	21	1.0		2.0	
HORMONES AND DRUGS AFFECTING ENDOCRINE FUNCTION (G-D6. OR G-D7) AND G-G1.703	117	6.0		6.0	
ANTI-INFECTIVE AGENTS (G-D20. OR G-D21) AND G-G1.703	283	8.0		17.0	
ANTINEOPLASTIC AGENTS G-D22. AND G-G1.703	62	1.0			
IMMUNOLOGIC FACTORS G-D24.611 AND G-G1.703	6	1.0			
ENVIRONMENTAL POLLUTANTS, PESTICIDES G-D5. AND G-G1.703	10	2.0			

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
BIOCHEMISTRY	974	32.0	2.1	75.0	3.3
G-G1.201 OR G-H1.181 OR G-G6					
BIOSYNTHESIS AND/OR METABOLISM:	570			75.0	
G-G6.184 OR G-G6.535					
AMINO ACIDS	58				
G-D12.125 AND G-G1.201					
PEPTIDES	12				
G-G6.535.770 OR G-D12.644 AND G-G1.201					
PROTEINS	76	4.0			
G-D12.776 AND G-G1.201					
ENZYMES	171	6.0			
G-D8 AND G-G1.201					
NUCLEIC ACIDS	19	1.0			
G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661 OR G6.184.680					
LIPIDS	84	2.0			
G-G1.201 AND G-D10 OR G6.535.585					
CARBOHYDRATES	62	1.0			
G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411					
MINERALS - ELECTROLYTES	163	7.0			
G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888 OR G-G6.535.166.310 OR G-G6.184.29 OR G-G7.621.110					
NUTRITION	101	1.0			
G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)					
IMMUNOLOGY	440	20.0	1.3	25.6	1.1
G-G4.610 OR G-D24.611 OR G-C20. OR G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449					
BASIC IMMUNOLOGY	222			12.6	
G-G4.610 OR G-D24.611					
CLINICAL IMMUNOLOGY	348	20.0		13.0	
G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449					
GENETICS	133			6.0	.2
G-G5 OR G-E5.393					

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
BEHAVIORAL SCIENCES G-F1. OR G-F2. OR G-F3. OR G-F4.	296	1.0	.0	130.6	5.7
BEHAVIOR AND BEHAVIOR MECHANISMS G-F1.	114			13.4	
PSYCHOLOGIC PROCESSES G-F2.	51				
BEHAVIORAL AND MENTAL DISORDERS G-F3.	193			45.4	
PSYCHIATRIC TESTS & THERAPY G-F4	39	1.0		20.8	
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278	155	16.0	1.0	213.8	9.4
POPULATION CHARACTERISTICS G-N1.	103				
HEALTH SERVICES G-N2.421	8				
ECONOMICS G-N3.219	1				
SOCIAL CONTROL G-N3.706 OR G-I1.880.604	2	1.0		11.0	
HEALTH SERVICES ADMINISTRATION G-N4.	10	15.0		172.2	
PUBLIC HEALTH AND PREVENTIVE MEDICINE G-G2.403.776.756 OR G-G3.807.665 OR G-N2.421.143.827 OR G-N2.421.726	92			8.0	
ENVIRONMENT AND ENVIRONMENTAL HAZARDS G-G3.230 OR G-G3.372	39			22.6	
GENERAL PATHOLOGY G2.403.776.642 OR (G-C23. AND NOT G-C23.888)	1070	17.0	1.1	20.8	.9
PATHOLOGIC PROCESSES G-C23.739	141	4.0		1.8	
COLLAGEN DISEASES G-C23.200	122	4.0		4.0	

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
LABORATORY MEDICINE - DIAGNOSIS, TECHNIQUES, METHODS G-E1.223 OR G-E5.196 OR G-E1.197 OR G-E5.909 OR G-E5.760	737	54.0	3.6	52.4	2.3
SPECIMEN HANDLING AND COLLECTION G-E1.223.894	65	6.0		7.2	
METHODS IN HEMATOLOGY G-E1.223.459	107	12.0		34.9	
BLOOD CHEMICAL ANALYSIS G-E1.223.174.229	115	3.0		2.0	
CYTODIAGNOSIS G-E1.223.230 OR G-E5.909.262	16			1.2	
PHYSICAL DIAGNOSIS G-E1.706 OR G-C23.888 OR E1.579	800	49.0	3.2	352.0	15.5
PHYSICAL EXAMINATION G-E1.706	225	15.0		101.0	
SIGNS AND SYMPTOMS G-C23.888	616	8.0			
MEDICAL HISTORY TAKING E1.579	6	2.0		69.0	
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044	138.0	9.2	59.6	2.6
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13	1.5		2.4	
CARDIOVASCULAR SURGERY G-E4.752	20			2.0	
DIGESTIVE SYSTEM SURGERY G-E4.765	80	10.0		2.0	
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28	8.5			
UROGENITAL SURGERY G-E4.887	24	.5		1.6	
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58	3.5		27.6	
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53	2.0		1.0	
MINOR SURGERY E4.806	2	2.0		1.8	

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
EMERGENCIES, INJURIES AND POISONING G-C21 OR G-E2.365	729	63.5	4.2	38.4	1.6
POISONING G-C21.613	401	1.0		2.7	
WOUNDS AND INJURIES G-C21.866	271	6.0		18.5	
EMERGENCIES AND TREATMENT C23.280.420 OR G-E2.365	52	6.5		15.2	
RADIOLOGY G2.403.776.830 OR G-E1.818 OR G-E5.799 OR G-E2.810	242	29.0	1.9	38.3	1.6
RADIOGRAPHY G-E1.818	161	19.0		38.3	
RADIOTHERAPY G-E2.810	20	2.0			
REHABILITATION G-E2.831 OR G2.403.776.713.643 OR G2.743	8	30.0	2.0		
OCCUPATIONAL THERAPY G-E2.831.489 OR G2.532	0	10.0			
PHYSICAL THERAPY G-E2.831.578 OR G2.671	8	10.0			
GYNECOLOGY AND OBSTETRICS G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13	1043	53.0	3.5	39.8	1.7
GYNECOLOGIC DISEASES G-C13.371	285	2.0		3.2	
NORMAL PREGNANCY AND DELIVERY G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786	287	1.0		12.0	
PREGNANCY COMPLICATIONS G-C13.703	262			1.2	
PEDIATRICS G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377	1266	175.0	11.7	76.5	3.3
GROWTH & DEVELOPMENT G-G7.553 OR G-F1.227	114			11.0	
THE NEWBORN INFANT G7.117.638.489	257	30.0		10.0	

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	86.0	3.0	49.5	2.1
BACTERIAL INFECTIONS G-C1.252	472				
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11			13.0	
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215				
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86	1.0		3.0	
MUSCULOSKELETAL DISEASES G-C5. OR G-C16.131.621 OR G-E1.642	303	38.5	2.5	24.5	1.0
BONE DISEASES G-C5.116 OR G-C16.131.621	98			2.0	
JOINT DISEASES G-C5.550 OR G-C5.799	155	7.5			
MUSCULAR DISEASES G-C5.651	52				
MYOGRAPHY G-E1.642	1	1.0			
RESPIRATORY DISEASES G-C8. OR G-C23.888.852	974	64.5	4.3	53.2	2.3
LUNG DISEASES G-C8.381	556	4.0			
PLEURAL DISEASES G-C8.528	84	2.0			
RESPIRATION DISORDERS G-C8.618 OR G-C23.888.852	227	5.5		1.6	
RESPIRATORY HYPERSENSITIVITY G-C8.674	53	8.5		3.3	
RESPIRATORY TRACT INFECTIONS G-C8.730	233	2.0			
RESPIRATORY THERAPY G-E2.365.647. OR G-E2.555. OR E5.497.578 OR E7.764	72	8.5		3.3	

PHYSICIAN ASSISTANT

MESH CODES

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
ENDOCRINE DISEASES G-C19. OR G-E1.197 OR G2.403.776.409.323	619	52.0	3.4	34.5	1.5
ADRENAL GLAND DISEASES G-C19.53	97	3.0			
DIABETES MELLITUS G-C19.246	149	4.0			
PARATHYROID DISEASES G-C19.642	39	1.0			
PITUITARY DISEASES G-C19.700	37	1.0			
THYROID DISEASES G-C19.874	155	3.0			
NUTRITIONAL AND METABOLIC DISEASES G-C18. OR G-E2.293	704	35.0	2.3		
DIGESTIVE SYSTEM DISEASES G-C6. OR G-C7. OR G-C23.888.821 OR G2.403.776.409.440	853	52.0	3.4	33.5	1.4
BILIARY TRACT DISEASES G-C6.130	63	1.0			
GASTROINTESTINAL DISEASES G-C6.405	427	9.0			
LIVER DISEASES G-C6.552	159	5.0			
OCULAR AND OTORHINOLARYNGOLOGIC DISEASES G-C11. OR G-C9. OR G-C21.866.366 OR G2.403.776.573 OR G2.553 OR G2.403.776.605 OR G-E1.276 OR G-E1.210	223	48.0	3.2	91.4	4.0
EAR DISEASES G-C9.218	42	1.0		17.7	
LARYNGEAL DISEASES G-C9.400	16			2.0	
NOSE DISEASES G-C9.603	14			2.0	
PHARYNGEAL DISEASES G-C9.775	19			2.0	
EYE DISEASES G-C11	107	2.0		48.7	
NEOPLASMS G-C4	909	31.5	2.1	7.5	.3

PHYSICIAN ASSISTANT

TEXT	# OF QUES.	DUKE HRS	DUKE PCT	SHEPPARD HRS	SHEPPARD PCT
MESH CODES					
CARDIOVASCULAR DISEASES G-C14. OR G-E1.145.569 OR G2.403.776.409.163 OR G-E1.399.214	924	68.0	4.5	101.8	4.4
HEART DISEASES G-C14.280	398	10.0		2.0	
HYPERTENSION G-C14.907.489	162	4.0			
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY G-E1.145.569 OR G-E1.399.214	145			32.3	
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579	41.5	2.7	33.5	1.4
UROLOGIC DISEASES G-C12	506	52.0	3.4	45.5	2.0
KIDNEY DISEASES G-C12.777.419	357	21.0		23.0	
URINARY CALCULI G-C12.777.809	5	1.0			
URINARY TRACT INFECTIONS G-C12.777.892	46	2.0			
DERMATOLOGIC DISEASES G2.403.776.185 OR G-C17. OR G-C23.888.885	299	46.0	3.0	61.5	2.7
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565	45.0	3.0	33.5	1.4
TOTAL HOURS IDENTIFIED		1487.9		2270.3	

DIETETICS

TEXTS	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	116.0	8.5	155.0	11.5
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	1.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	13.0			
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	16.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	9.0			
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	17.0			
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	14.0			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	5.0			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	20.0			
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	11.0			
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	3.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	7.0			
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75				
MICROBIOLOGY G-G1.273.540	536	60.0	4.4	50.0	3.7
BACTERIA G-B3 AND G-G1.273.540	301	28.0			
VIRUSES G-B4 AND G-G1.273.540	85	6.0			
RICKETTSIA G-B3.542.651 AND G-G1.273.540	9	2.0			
FUNGI G-B5.354 AND G-G1.273.540	20	6.0			
COMMON PARASITES G-B1 AND G-G1.273.540	13	6.0			
BACTERIOLOGICAL TECHNIQUES G-E5.909.123 OR G-D26.342	41			20.0	

DIETETICS

	# OF	UMCU		GEORGIA ST.	
TEXT	QUES.	HRS	PCT	HRS	PCT
MESH CODES					
PHARMACOLOGY G-G1.703 OR G-G2.628 OR G-G12.	1139	9.5	.6	50.0	3.
GENERAL PHARMACOLOGY G-G12.	128				
TOXICOLOGY G-C21.613.276 OR G1.703.795 OR G2.628.795	375				
DRUGS ACTING PRIMARILY ON THE CENTRAL NERVOUS SYSTEM (G-D15. OR G-D14) AND G-G1.703	221				
DRUGS ACTING PRIMARILY ON THE PERIPHERAL NERVOUS SYSTEM (G-D16. OR G-D17) AND G-G1.703	132				
DRUGS ACTING PRIMARILY ON THE CARDIOVASCULAR SYSTEM G-D18. AND G-G1.703	102				
HEMATOLOGIC AGENTS G-D19.461 AND G-G1.703	37				
RENAL AGENTS G-D19.770 AND G-G1.703	55	.5			
GASTROINTESTINAL AGENTS G-D19.316 AND G-G1.703	21				
HORMONES AND DRUGS AFFECTING ENDOCRINE FUNCTION (G-D6. OR G-D7) AND G-G1.703	117				
ANTI-INFECTIVE AGENTS (G-D20. OR G-D21) AND G-G1.703	283	9.0			
ANTINEOPLASTIC AGENTS G-D22. AND G-G1.703	62				
IMMUNOLOGIC FACTORS G-D24.611 AND G-G1.703	6				
ENVIRONMENTAL POLLUTANTS, PESTICIDES G-D5. AND G-G1.703	10				

DIETETICS

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
BIOCHEMISTRY G-G1.201 OR G-H1.181 OR G-G6	974	519.4	38.1	790.0	58.9
BIOSYNTHESIS AND/OR METABOLISM: G-G6.184 OR G-G6.535	570	27.0			
AMINO ACIDS G-D12.125 AND G-G1.201	58	7.0			
PEPTIDES G-G6.535.770 OR G-D12.644 AND G-G1.201	12				
PROTEINS G-D12.776 AND G-G1.201	76	12.3		30.0	
ENZYMES G-D8 AND G-G1.201	171	10.0			
NUCLEIC ACIDS G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661 OR G6.184.680	19	16.0			
LIPIDS G-G1.201 AND G-D10 OR G6.535.585	84	24.3		15.0	
CARBOHYDRATES G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411	62	30.3		15.0	
MINERALS - ELECTROLYTES G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888 OR G-G6.535.166.310 OR G-G6.184.29 OR G-G7.621.110	163	13.0			
NUTRITION G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)	101	189.5		510.0	
IMMUNOLOGY G-G4.610 OR G-D24.611 OR G-C20. OR G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	440	12.0	.8		
BASIC IMMUNOLOGY G-G4.610 OR G-D24.611	222	3.0			
CLINICAL IMMUNOLOGY G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	348	6.0			
GENETICS G-G5 OR G-E5.393	133	49.0	3.6		

DIETETICS

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
BEHAVIORAL SCIENCES G-F1. OR G-F2. OR G-F3. OR G-F4.	296	101.0	7.4	120.0	8.9
BEHAVIOR AND BEHAVIOR MECHANISMS G-F1.	114	22.0		15.0	
PSYCHOLOGIC PROCESSES G-F2.	51	30.0		15.0	
BEHAVIORAL AND MENTAL DISORDERS G-F3.	193				
PSYCHIATRIC TESTS & THERAPY G-F4	39				
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278	155	237.0	17.4	80.0	5.9
POPULATION CHARACTERISTICS G-N1.	103				
HEALTH SERVICES G-N2.421	8	39.0		80.0	
ECONOMICS G-N3.219	1				
SOCIAL CONTROL G-N3.706 OR G-I1.880.604	2				
HEALTH SERVICES ADMINISTRATION G-N4.	10	111.0			
PUBLIC HEALTH AND PREVENTIVE MEDICINE G-G2.403.776.756 OR G-G3.807.665 OR G-N2.421.143.827 OR G-N2.421.726	92	8.0			
ENVIRONMENT AND ENVIRONMENTAL HAZARDS G-G3.230 OR G-G3.372	39	8.0			

DIETETICS

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
LABORATORY MEDICINE - DIAGNOSIS, TECHNIQUES, METHODS G-E1.223 OR G-E5.196 OR G-E1.197 OR G-E5.909 OR G-E5.760	737	13.0	.9		
SPECIMEN HANDLING AND COLLECTION G-E1.223.894	65				
METHODS IN HEMATOLOGY G-E1.223.459	107	4.0			
BLOOD CHEMICAL ANALYSIS G-E1.223.174.229	115				
CYTODIAGNOSIS G-E1.223.230 OR G-E5.909.262	16				
PHYSICAL DIAGNOSIS G-E1.706 OR G-C23.888 OR E1.579	800	8.5	.6		
PHYSICAL EXAMINATION G-E1.706	225	2.0			
SIGNS AND SYMPTOMS G-C23.888	616	6.5			
MEDICAL HISTORY TAKING E1.579	6				
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044	11.0	.8		
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13				
CARDIOVASCULAR SURGERY G-E4.752	20				
DIGESTIVE SYSTEM SURGERY G-E4.765	80	2.0			
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28				
UROGENITAL SURGERY G-E4.887	24				
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58				
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53				
MINOR SURGERY E4.806	2				

DIETETICS

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
EMERGENCIES, INJURIES AND POISONING G-C21 OR G-E2.365	729	3.5	.2		
POISONING G-C21.613	401				
WOUNDS AND INJURIES G-C21.866	271	3.5			
EMERGENCIES AND TREATMENT C23.280.420 OR G-E2.365	52				
GYNECOLOGY AND OBSTETRICS G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13	1043	9.0	.6		
GYNECOLOGIC DISEASES G-C13.371	285				
NORMAL PREGNANCY AND DELIVERY G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786	287	9.0			
PREGNANCY COMPLICATIONS G-C13.703	262				
PEDIATRICS G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377	1266	10.0	.7	30.0	2.2
GROWTH & DEVELOPMENT G-G7.553 OR G-F1.227	114				
THE NEWBORN INFANT G7.117.638.489	257				
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	7.5	.5		
BACTERIAL INFECTIONS G-C1.252	472	1.5			
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11	3.0			
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215				
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.784	86				

DIETETICS

TEXT	# OF QUES.	UMCD HRS	UMCD PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
ENDOCRINE DISEASES G-C19. OR G-E1.197 OR G2.403.776.409.323	619	11.0	.8		
ADRENAL GLAND DISEASES G-C19.53	97				
DIABETES MELLITUS G-C19.246	149				
PARATHYROID DISEASES G-C19.642	39				
PITUITARY DISEASES G-C19.700	37				
THYROID DISEASES G-C19.874	155				
NUTRITIONAL AND METABOLIC DISEASES G-C18. OR G-E2.293	704	110.5	8.1	65.0	4.8
DIGESTIVE SYSTEM DISEASES G-C6. OR G-C7. OR G-C23.888.821 OR G2.403.776.409.440	853	21.0	1.5		
BILIARY TRACT DISEASES G-C6.130	63	3.0			
GASTROINTESTINAL DISEASES G-C6.405	427	7.0			
LIVER DISEASES G-C6.552	159	3.0			
MUSCULOSKELETAL DISEASES G-C5. OR G-C16.131.621 OR G-E1.642	303	8.0	.5		
BONE DISEASES G-C5.116 OR G-C16.131.621	98				
JOINT DISEASES G-C5.550 OR G-C5.799	155				
MUSCULAR DISEASES G-C5.651	52				
MYOGRAPHY G-E1.642	1				

DIETETICS

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
CARDIOVASCULAR DISEASES G-C14. OR G-E1.145.569 OR G2.403.776.409.163 OR G-E1.399.214	924	13.5	.9		
HEART DISEASES G-C14.280	398	.5			
HYPERTENSION G-C14.907.489	162				
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY G-E1.145.569 OR G-E1.399.214	145	2.0			
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579	11.0	.8		
UROLOGIC DISEASES G-C12	506	11.5	.8		
KIDNEY DISEASES G-C12.777.419	357	.5			
URINARY CALCULI G-C12.777.809	5				
URINARY TRACT INFECTIONS G-C12.777.892	46				
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565	8.0	.5		
TOTAL HOURS IDENTIFIED		1360.9		1340.0	

MEDICAL TECHNOLOGY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	127.0	7.3	120.0	10.5
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	2.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	12.0			
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	4.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	10.0			
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	44.0			
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	16.0			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	3.0			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	19.0			
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	13.0			
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	6.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	6.0			
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75	1.0			
MICROBIOLOGY G-G1.273.540	536	292.0	16.8	225.0	19.8
BACTERIA G-B3 AND G-G1.273.540	[illegible]	[illegible]		30.0	
VIRUSES G-B4 AND G-G1.273.540	[illegible]	16.0		30.0	
RICKETTSIA G-B3.542.651 AND G-G1.273.540	9	2.0			
FUNGI G-B5.354 AND G-G1.273.540	20	35.0		22.5	
COMMON PARASITES G-B1 AND G-G1.273.540	13	32.0		22.5	
BACTERIOLOGICAL TECHNIQUES G-E5.909.123 OR G-D26.342	41	151.0		52.5	

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                                                         MEDICAL TECHNOLOGY
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                                                         # OF          UMCO           GEORGIA ST.
                           TEXT                          QUES.     HRS      PCT      HRS      PCT
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                              MESH CODES
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BIOCHEMISTRY                                              974    633.0     36.5    262.5     23.1
          G-G1.201 OR G-H1.181 OR G-G6
   BIOSYNTHESIS AND/OR METABOLISM:                        570
          G-G6.184 OR G-G6.535
      AMINO ACIDS                                          58      6.0
          G-D12.125 AND G-G1.201
      PEPTIDES                                             12
          G-G6.535.770 OR G-D12.644 AND G-G1.201
      PROTEINS                                             76     11.0
          G-D12.776 AND G-G1.201
         ENZYMES                                          171     10.0
          G-D8 AND G-G1.201
      NUCLEIC ACIDS                                        19     14.0
          G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661
          OR G6.184.680
      LIPIDS                                               84     21.0
          G-G1.201 AND G-D10 OR G6.535.585
      CARBOHYDRATES                                        62     28.0
          G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411
      MINERALS - ELECTROLYTES                             163     11.0
          G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888
          OR G-G6.535.166.[illegible]10 OR G-G6.184.29 OR G-G7.621.110
   NUTRITION                                              101      9.0
          G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)


IMMUNOLOGY                                                440    141.0      8.1    114.0     10.0
          G-G4.610 OR G-D24.611 OR G-C20. OR
          G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR
          G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR
          G-E2.95.377 OR G-E2.95.449
   BASIC IMMUNOLOGY                                       222                       45.0
          G-G4.610 OR G-D24.611
   CLINICAL IMMUNOLOGY                                    348    115.0              69.0
          G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR
          G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR
          G-E2.95.449


GENETICS
          G-G5 OR G-E5.393                                133     48.5      2.8
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MEDICAL TECHNOLOGY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
PHARMACOLOGY	1139	17.0	.9	45.0	3.9
G-G1.703 OR G-G2.628 OR G-G12.					
GENERAL PHARMACOLOGY	128				
G-G12.					
TOXICOLOGY	375				
G-C21.613.276 OR G1.703.795 OR G2.628.795					
DRUGS ACTING PRIMARILY ON THE CENTRAL NERVOUS SYSTEM	221				
(G-D15. OR G-D14) AND G-G1.703					
DRUGS ACTING PRIMARILY ON THE PERIPHERAL NERVOUS SYSTEM	132				
(G-D16. OR G-D17) AND G-G1.703					
DRUGS ACTING PRIMARILY ON THE CARDIOVASCULAR SYSTEM	102				
G-D18. AND G-G1.703					
HEMATOLOGIC AGENTS	37	8.0			
G-D19.461 AND G-G1.703					
RENAL AGENTS	55				
G-D19.770 AND G-G1.703					
GASTROINTESTINAL AGENTS	21				
G-D19.316 AND G-G1.703					
HORMONES AND DRUGS AFFECTING ENDOCRINE FUNCTION	117				
(G-D6. OR G-D7) AND G-G1.703					
ANTI-INFECTIVE AGENTS	283	9.0			
(G-D20. OR G-D21) AND G-G1.703					
ANTINEOPLASTIC AGENTS	62				
G-D22. AND G-G1.703					
IMMUNOLOGIC FACTORS	6				
G-D24.611 AND G-G1.703					
ENVIRONMENTAL POLLUTANTS, PESTICIDES	10				
G-D5. AND G-G1.703					
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH	155	3.0	.1	37.5	3.3
G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR					
G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278					
POPULATION CHARACTERISTICS	103				
G-N1.					
HEALTH SERVICES	8				
G-N2.421					
ECONOMICS	1				
G-N3.219					
SOCIAL CONTROL	2				
G-N3.706 OR G-I1.880.604					
HEALTH SERVICES ADMINISTRATION	10			37.5	
G-N4.					
PUBLIC HEALTH AND PREVENTIVE MEDICINE	92	1.0			
G-G2.403.776.756 OR G-G3.807.665 OR					
G-N2.421.143.827 OR G-N2.421.726					
ENVIRONMENT AND ENVIRONMENTAL HAZARDS	39	2.0			
G-G3.230 OR G-G3.372					

MEDICAL TECHNOLOGY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
BEHAVIORAL SCIENCES	296	77.0	4.4	45.0	3.9
G-F1. OR G-F2. OR G-F3. OR G-F4.					
BEHAVIOR AND BEHAVIOR MECHANISMS	114	2.0			
G-F1.					
PSYCHOLOGIC PROCESSES	51	30.0			
G-F2.					
BEHAVIORAL AND MENTAL DISORDERS	193				
G-F3.					
PSYCHIATRIC TESTS & THERAPY	39				
G-F4					
LABORATORY MEDICINE - DIAGNOSIS, TECHNIQUES, METHODS	737	271.0	15.6	262.5	23.1
G-E1.223 OR G-E5.196 OR G-E1.197 OR G-E5.909 OR G-E5.760					
SPECIMEN HANDLING AND COLLECTION	65	12.0			
G-E1.223.894					
METHODS IN HEMATOLOGY	107	172.0		67.5	
G-E1.223.459					
BLOOD CHEMICAL ANALYSIS	115				
G-E1.223.174.229					
CYTODIAGNOSIS	16	4.0			
G-E1.223.230 OR G-E5.909.262					
PHYSICAL DIAGNOSIS	800	2.0	.1		
G-E1.706 OR G-C23.888 OR E1.579					
PHYSICAL EXAMINATION	225	2.0			
G-E1.706					
SIGNS AND SYMPTOMS	616				
G-C23.888					
MEDICAL HISTORY TAKING	6				
E1.579					
PEDIATRICS	1266	5.0	.2		
G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377					
GROWTH & DEVELOPMENT	114				
G-G7.553 OR G-F1.227					
THE NEWBORN INFANT	257				
G7.117.638.489					

MEDICAL TECHNOLOGY

TEXT	# OF QUES.	UMCD HRS	UMCD PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	53.0	3.0		
BACTERIAL INFECTIONS G-C1.252	472	10.0			
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11	3.0			
MYCOSES G-C1.703	99	10.0			
RICKETTSIAL DISEASES G-C2.568	33	1.0			
VIRUS DISEASES G-C2.818	215	15.0			
PARASITIC DISEASES G-C3	91	11.0			
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86				
NUTRITIONAL AND METABOLIC DISEASES G-C18. OR G-E2.293	704			22.5	1.9
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579	62.0	3.5		
TOTAL HOURS IDENTIFIED		1731.5		1134.0	

OCCUPATIONAL THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	AMA ESSENTIALS HRS	AMA ESSENTIALS PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	287.0	19.1	135.0	20.0
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	3.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	153.0		30.0	
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	7.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	10.0			
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	24.0			
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	9.5			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	6.5			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	47.0		45.0	
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	12.0			
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	4.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	7.0			
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75	1.0			
IMMUNOLOGY G-G4.610 OR G-D24.611 OR G-C20. OR G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	440	1.0	.0		
BASIC IMMUNOLOGY G-G4.610 OR G-D24.611	222				
CLINICAL IMMUNOLOGY G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	348	1.0			

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                                                         OCCUPATIONAL THERAPY
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                                                          # OF       UMCU             AMA ESSENTIALS
                           TEXT                           QUES.   HRS      PCT        HRS      PCT
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                        MESH CODES
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BIOCHEMISTRY                                               974    5.0       .3
            G-G1.201 OR G-H1.181 OR G-G6
   BIOSYNTHESIS AND/OR METABOLISM:                         570
            G-G6.184 OR G-G6.535
      AMINO ACIDS                                           58
            G-D12.125 AND G-G1.201
      PEPTIDES                                              12
            G-G6.535.770 OR G-D12.644 AND G-G1.201
      PROTEINS                                              76
            G-D12.776 AND G-G1.201
         ENZYMES                                           171
            G-D8 AND G-G1.201
      NUCLEIC ACIDS                                         19
            G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661
            OR G6.184.680
      LIPIDS                                                84
            G-G1.201 AND G-D10 OR G6.535.585
      CARBOHYDRATES                                         62
            G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411
      MINERALS - ELECTROLYTES                              163
            G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888
            OR G-G6.535.166.310 OR G-G6.184.29 OR G-G7.621.110
   NUTRITION                                               101    5.0
            G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)



GENETICS
            G-G5 OR G-E5.393                               133    3.5       .2


HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH            155   75.0      4.9
            G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR
            G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278
   POPULATION CHARACTERISTICS                              103
            G-N1.
   HEALTH SERVICES                                           8
            G-N2.421
   ECONOMICS                                                 1
            G-N3.219
   SOCIAL CONTROL                                            2
            G-N3.706 OR G-I1.880.604
   HEALTH SERVICES ADMINISTRATION                           10   30.0
            G-N4.
   PUBLIC HEALTH AND PREVENTIVE MEDICINE                    92
            G-G2.403.776.756 OR G-G3.807.665 OR
            G-N2.421.143.827 OR G-N2.421.726
   ENVIRONMENT AND ENVIRONMENTAL HAZARDS                    39
            G-G3.230 OR G-G3.372
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OCCUPATIONAL THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	AMA ESSENTIALS HRS	AMA ESSENTIALS PCT
MESH CODES					
BEHAVIORAL SCIENCES					
G-F1. OR G-F2. OR G-F3. OR G-F4.	296	243.0	16.1	150.0	22.2
BEHAVIOR AND BEHAVIOR MECHANISMS					
G-F1.	114	52.0			
PSYCHOLOGIC PROCESSES					
G-F2.	51	31.0			
BEHAVIORAL AND MENTAL DISORDERS					
G-F3.	193	33.0			
PSYCHIATRIC TESTS & THERAPY					
G-F4	39	13.0			
PHYSICAL DIAGNOSIS					
G-E1.706 OR G-C23.888 OR E1.579	800	2.0	.1		
PHYSICAL EXAMINATION					
G-E1.706	225	2.0			
SIGNS AND SYMPTOMS					
G-C23.888	616				
MEDICAL HISTORY TAKING					
E1.579	6				
GENERAL PATHOLOGY					
G2.403.776.642 OR (G-C23. AND NOT G-C23.888)	1070	12.0	.7	45.0	6.6
PATHOLOGIC PROCESSES					
G-C23.739	141	5.0			
COLLAGEN DISEASES					
G-C23.200	122				
REHABILITATION					
G-E2.831 OR G2.403.776.713.643 OR G2.743	8	738.0	49.1	315.0	46.6
OCCUPATIONAL THERAPY					
G-E2.831.489 OR G2.532	0	727.0		315.0	
PHYSICAL THERAPY					
G-E2.831.578 OR G2.671	8	10.0			
EMERGENCIES, INJURIES AND POISONING					
G-C21 OR G-E2.365	729	1.0	.0		
POISONING					
G-C21.613	401				
WOUNDS AND INJURIES					
G-C21.866	271	1.0			
EMERGENCIES AND TREATMENT					
C23.280.420 OR G-E2.365	52				

OCCUPATIONAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	AMA ESSENTIALS HRS	AMA ESSENTIALS PCT
MESH CODES					
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044	20.0	1.3		
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13				
CARDIOVASCULAR SURGERY G-E4.752	20				
DIGESTIVE SYSTEM SURGERY G-E4.765	80				
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28				
UROGENITAL SURGERY G-E4.887	24				
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58	20.0			
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53				
MINOR SURGERY E4.806	2				
GYNECOLOGY AND OBSTETRICS G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13	1043	1.0	.0		
GYNECOLOGIC DISEASES G-C13.371	285	1.0			
NORMAL PREGNANCY AND DELIVERY G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786	287				
PREGNANCY COMPLICATIONS G-C13.703	262				
PEDIATRICS G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377	1266	31.0	2.0	30.0	4.4
GROWTH & DEVELOPMENT G-G7.553 OR G-F1.227	114	30.0		30.0	
THE NEWBORN INFANT G7.117.638.489	257				

OCCUPATIONAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	AMA ESSENTIALS HRS	AMA ESSENTIALS PCT
MESH CODES					
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	2.9	.1		
BACTERIAL INFECTIONS G-C1.252	472				
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11				
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215				
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86				
MUSCULOSKELETAL DISEASES G-C5. OR G-C16.131.621 OR G-E1.642	303	37.0	2.4		
BONE DISEASES G-C5.116 OR G-C16.131.621	98				
JOINT DISEASES G-C5.550 OR G-C5.799	155	1.0			
MUSCULAR DISEASES G-C5.651	52	9.0			
MYOGRAPHY G-E1.642	1	3.0			
RESPIRATORY DISEASES G-C8. OR G-C23.888.852	974	4.0	.2		
LUNG DISEASES G-C8.381	556				
PLEURAL DISEASES G-C8.528	84				
RESPIRATION DISORDERS G-C8.618 OR G-C23.888.852	227				
RESPIRATORY HYPERSENSITIVITY G-C8.674	53				
RESPIRATORY TRACT INFECTIONS G-C8.730	233				
RESPIRATORY THERAPY G-E2.365.647. OR G-E2.555. OR E5.497.578 OR E7.764	72				

OCCUPATIONAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	AMA ESSENTIALS HRS	AMA ESSENTIALS PCT
MESH CODES					
ENDOCRINE DISEASES G-C19. OR G-E1.197 OR G2.403.776.409.323	619	2.0	.1		
ADRENAL GLAND DISEASES G-C19.53	97				
DIABETES MELLITUS G-C19.246	149				
PARATHYROID DISEASES G-C19.642	39				
PITUITARY DISEASES G-C19.700	37				
THYROID DISEASES G-C19.874	155				
DIGESTIVE SYSTEM DISEASES G-C6. OR G-C7. OR G-C23.888.821 OR G2.403.776.409.440	853	3.0	.1		
BILIARY TRACT DISEASES G-C6.130	63				
GASTROINTESTINAL DISEASES G-C6.405	427				
LIVER DISEASES G-C6.552	159				
OCULAR AND OTORHINOLARYNGOLOGIC DISEASES G-C11. OR G-C9. OR G-C21.866.366 OR G2.403.776.573 OR G2.553 OR G2.403.776.605 OR G-E1.276 OR G-E1.210	223	2.0	.1		
EAR DISEASES G-C9.218	42	1.0			
LARYNGEAL DISEASES G-C9.400	16				
NOSE DISEASES G-C9.603	14				
PHARYNGEAL DISEASES G-C9.775	19				
EYE DISEASES G-C11	107	1.0			
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565	12.0	.7		

OCCUPATIONAL THERAPY

TEXT	# OF QUES.	OMCO HRS	OMCO PCT	AMA ESSENTIAL HRS	AMA ESSENTIAL PCT
MESH CODES					
CARDIOVASCULAR DISEASES G-C14. OR G-E1.145.569 OR G2.403.776.409.183 OR G-E1.399.214	924	9.0	.5		
HEART DISEASES G-C14.280	398	4.0			
HYPERTENSION G-C14.907.489	162				
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY G-E1.145.569 OR G-E1.399.214	145	2.0			
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579	2.0	.1		
UROLOGIC DISEASES G-C12	506	2.0	.1		
KIDNEY DISEASES G-C12.777.419	357				
URINARY CALCULI G-C12.777.809	5				
URINARY TRACT INFECTIONS G-C12.777.892	46				
NEOPLASMS G-C4	909	2.0	.1		
DERMATOLOGIC DISEASES G2.403.776.185 OR G-C17. OR G-C23.888.885	299	4.0	.2		
TOTAL HOURS IDENTIFIED		1500.5		675.0	

PHYSICAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	264.5	20.2	278.0	21.
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	3.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	126.5		88.0	
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	8.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	10.0			
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	24.0			
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	10.0			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	6.0			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	42.0		50.0	
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	18.0			
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	5.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	10.0			
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75	6.0			
IMMUNOLOGY G-G4.610 OR G-D24.611 OR G-C20. OR G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	440	.5	.0		
BASIC IMMUNOLOGY G-G4.610 OR G-D24.611	222				
CLINICAL IMMUNOLOGY G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	348	.5			

PHYSICAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
BIOCHEMISTRY G-G1.201 OR G-H1.181 OR G-G6	974	110.0	8.4	100.0	7.7
BIOSYNTHESIS AND/OR METABOLISM: G-G6.184 OR G-G6.535	570				
AMINO ACIDS G-D12.125 AND G-G1.201	58				
PEPTIDES G-G6.535.770 OR G-D12.644 AND G-G1.201	12				
PROTEINS G-D12.776 AND G-G1.201	76				
ENZYMES G-D8 AND G-G1.201	171				
NUCLEIC ACIDS G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661 OR G6.184.680	19				
LIPIDS G-G1.201 AND G-D10 OR G6.535.585	84				
CARBOHYDRATES G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411	62				
MINERALS - ELECTROLYTES G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888 OR G-G6.535.166.310 OR G-G6.184.29 OR G-G7.621.110	163	4.0			
NUTRITION G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)	101	5.0			
GENETICS G-G5 OR G-E5.393	133	3.5	.2	10.0	.7
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278	155	90.0	6.8	98.0	7.5
POPULATION CHARACTERISTICS G-N1.	103				
HEALTH SERVICES G-N2.421	8				
ECONOMICS G-N3.219	1	5.0			
SOCIAL CONTROL G-N3.706 OR G-I1.880.604	2	5.0			
HEALTH SERVICES ADMINISTRATION G-N4.	10	35.0		8.0	
PUBLIC HEALTH AND PREVENTIVE MEDICINE G-G2.403.776.756 OR G-G3.807.665 OR G-N2.421.143.827 OR G-N2.421.726	92				
ENVIRONMENT AND ENVIRONMENTAL HAZARDS G-G3.230 OR G-G3.372	39				

PHYSICAL THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
BEHAVIORAL SCIENCES G-F1. OR G-F2. OR G-F3. OR G-F4.	296	173.0	13.2	167.5	12.9
BEHAVIOR AND BEHAVIOR MECHANISMS G-F1.	114	47.0		100.0	
PSYCHOLOGIC PROCESSES G-F2.	51	30.0			
BEHAVIORAL AND MENTAL DISORDERS G-F3.	193	6.0		17.5	
PSYCHIATRIC TESTS & THERAPY G-F4	39				
PHYSICAL DIAGNOSIS G-E1.706 OR G-C23.888 OR E1.579	800	2.0	.1	4.0	.3
PHYSICAL EXAMINATION G-E1.706	225				
SIGNS AND SYMPTOMS G-C23.888	616				
MEDICAL HISTORY TAKING E1.579	6				
GENERAL PATHOLOGY G2.403.776.642 OR (G-C23. AND NOT G-C23.888)	1070	14.0	1.0		
PATHOLOGIC PROCESSES G-C23.739	141	5.0			
COLLAGEN DISEASES G-C23.200	122	2.0			
REHABILITATION G-E2.831 OR G2.403.776.713.643 OR G2.743	8	481.0	36.8	440.0	33.9
OCCUPATIONAL THERAPY G-E2.831.489 OR G2.532	0				
PHYSICAL THERAPY G-E2.831.578 OR G2.671	8	481.0		440.0	
EMERGENCIES, INJURIES AND POISONING G-C21 OR G-E2.365	729	15.0	1.1		
POISONING G-C21.613	401				
WOUNDS AND INJURIES G-C21.866	271	15.0			
EMERGENCIES AND TREATMENT C23.280.420 OR G-E2.365	52				

PHYSICAL THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044	28.0	2.1	40.0	3.
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13				
CARDIOVASCULAR SURGERY G-E4.752	20				
DIGESTIVE SYSTEM SURGERY G-E4.765	80				
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28				
UROGENITAL SURGERY G-E4.887	24				
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58	28.0		40.0	
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53				
MINOR SURGERY E4.806	2				
GYNECOLOGY AND OBSTETRICS G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13	1043	2.0	.1		
GYNECOLOGIC DISEASES G-C13.371	285	1.0			
NORMAL PREGNANCY AND DELIVERY G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786	287	1.0			
PREGNANCY COMPLICATIONS G-C13.703	262				
PEDIATRICS G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377	1266	3.0	.2	60.0	4.6
GROWTH & DEVELOPMENT G-G7.553 OR G-F1.227	114				
THE NEWBORN INFANT G7.117.638.489	257				

PHYSICAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	3.0	.2		
BACTERIAL INFECTIONS G-C1.252	472	2.5			
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11				
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215	.5			
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86				
MUSCULOSKELETAL DISEASES G-C5. OR G-C16.131.621 OR G-E1.642	303	66.0	5.0	70.0	5.3
BONE DISEASES G-C5.116 OR G-C16.131.621	98	8.0			
JOINT DISEASES G-C5.550 OR G-C5.799	155	3.0		10.0	
MUSCULAR DISEASES G-C5.651	52	19.0		50.0	
MYOGRAPHY G-E1.642	1	3.0			
RESPIRATORY DISEASES G-C8. OR G-C23.888.852	974	7.0	.5	10.0	.7
LUNG DISEASES G-C8.381	556				
PLEURAL DISEASES G-C8.528	84				
RESPIRATION DISORDERS G-C8.618 OR G-C23.888.852	227				
RESPIRATORY HYPERSENSITIVITY G-C8.674	53				
RESPIRATORY TRACT INFECTIONS G-C8.730	233				
RESPIRATORY THERAPY G-E2.365.647. OR G-E2.555. OR E5.497.578 OR E7.764	72				

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                                                         PHYSICAL THERAPY
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                                                        # OF        UMCU           GEORGIA ST.
                         TEXT                           QUES.    HRS      PCT     HRS      PCT
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                     MESH CODES
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DIGESTIVE SYSTEM DISEASES                                853     3.0       .2
            G-C6. OR G-C7. OR G-C23.888.821 OR
            G2.403.776.409.440
  BILIARY TRACT DISEASES                                  63
            G-C6.130
  GASTROINTESTINAL DISEASES                              427
            G-C6.405
  LIVER DISEASES                                         159
            G-C6.552


CARDIOVASCULAR DISEASES                                  924     9.0       .6   10.0       .7
            G-C14. OR G-E1.145.569 OR G2.403.776.409.163 OR
            G-E1.399.214
  HEART DISEASES                                         398     4.0
            G-C14.280
     HYPERTENSION                                        162
            G-C14.907.489
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY                145     2.0
            G-E1.145.569 OR G-E1.399.214


HEMIC AND LYMPHATIC DISEASES                             579     2.0       .1
            G-C15. OR G2.403.776.409.543


DERMATOLOGIC DISEASES                                    299     4.0       .3
            G2.403.776.185 OR G-C17. OR G-C23.888.885


ENDOCRINE DISEASES                                       619     3.0       .2
            G-C19. OR G-E1.197 OR G2.403.776.409.323
  ADRENAL GLAND DISEASES                                  97
            G-C19.53
  DIABETES MELLITUS                                      149     1.0
            G-C19.246
  PARATHYROID DISEASES                                    39
            G-C19.642
  PITUITARY DISEASES                                      37
            G-C19.700
  THYROID DISEASES                                       155
            G-C19.874
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PHYSICAL THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	GEORGIA ST. HRS	GEORGIA ST. PCT
MESH CODES					
NEOPLASMS G-C4	909	3.0	.2		
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565	15.0	1.1	10.0	.7
UROLOGIC DISEASES G-C12	506	3.0	.2		
KIDNEY DISEASES G-C12.777.419	357	1.0			
URINARY CALCULI G-C12.777.809	5				
URINARY TRACT INFECTIONS G-C12.777.892	46				
TOTAL HOURS IDENTIFIED		1304.5		1297.5	

RADIOLOGIC TECHNOLOGY

TEXT MESH CODES	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCU HRS	UMCU PCT
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	190.0	35.5	60.0	14.0
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	1.5			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	143.5			
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	5.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	5.0			
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	5.0			
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	6.0			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	5.0			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	7.0			
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250				
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	4.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179				
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75				
EMERGENCIES, INJURIES AND POISONING G-C21 OR G-E2.365	729	11.0	2.0		
POISONING G-C21.613	401				
WOUNDS AND INJURIES G-C21.866	271	7.0			
EMERGENCIES AND TREATMENT C23.280.420 OR G-E2.365	52	4.0			

TEXT	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCU HRS	UMCU PCT
MESH CODES					
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044				
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13				
CARDIOVASCULAR SURGERY G-E4.752	20				
DIGESTIVE SYSTEM SURGERY G-E4.765	80				
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28				
UROGENITAL SURGERY G-E4.887	24				
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58				
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53				
MINOR SURGERY E4.806	2				
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR G-K1.316 OR G-M1.548.832 OR G-N2.421 OR G-N2.278	155	4.0	.7	35.0	8.1
POPULATION CHARACTERISTICS G-N1.	103				
HEALTH SERVICES G-N2.421	8			20.0	
ECONOMICS G-N3.219	1				
SOCIAL CONTROL G-N3.706 OR G-I1.880.604	2				
HEALTH SERVICES ADMINISTRATION G-N4.	10	4.0		15.0	
PUBLIC HEALTH AND PREVENTIVE MEDICINE G-G2.403.776.756 OR G-G3.807.665 OR G-N2.421.143.827 OR G-N2.421.726	92				
ENVIRONMENT AND ENVIRONMENTAL HAZARDS G-G3.230 OR G-G3.372	39				

RADIOLOGIC TECHNOLOGY

TEXT	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCU HRS	UMCU PCT
MESH CODES					
RADIOLOGY	242	329.0	61.6	349.0	81.4
G2.403.776.830 OR G-E1.818 OR G-E5.799 OR G-E2.810					
RADIOGRAPHY	161	51.0		73.0	
G-E1.818					
RADIOTHERAPY	20	4.0		10.0	
G-E2.810					
GYNECOLOGY AND OBSTETRICS	1043				
G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13					
GYNECOLOGIC DISEASES	285				
G-C13.371					
NORMAL PREGNANCY AND DELIVERY	287				
G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786					
PREGNANCY COMPLICATIONS	262				
G-C13.703					
PEDIATRICS	1266				
G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377					
GROWTH & DEVELOPMENT	114				
G-G7.553 OR G-F1.227					
THE NEWBORN INFANT	257				
G7.117.638.489					
MUSCULOSKELETAL DISEASES	303			1.5	.3
G-C5. OR G-C16.131.621 OR G-E1.642					
BONE DISEASES	98				
G-C5.116 OR G-C16.131.621					
JOINT DISEASES	155				
G-C5.550 OR G-C5.799					
MUSCULAR DISEASES	52				
G-C5.651					
MYOGRAPHY	1				
G-E1.642					

RADIOLOGIC TECHNOLOGY

TEXT	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCO HRS	UMCO PCT
MESH CODES					
RESPIRATORY DISEASES G-C8. OR G-C23.888.852	974			1.5	.3
LUNG DISEASES G-C8.381	556				
PLEURAL DISEASES G-C8.528	84				
RESPIRATION DISORDERS G-C8.618 OR G-C23.888.852	227				
RESPIRATORY HYPERSENSITIVITY G-C8.674	53				
RESPIRATORY TRACT INFECTIONS G-C8.730	233				
RESPIRATORY THERAPY G-E2.365.647. OR G-E2.555. OR E6.497.578 OR E7.764	72				
OCULAR AND OTORHINOLARYNGOLOGIC DISEASES G-C11. OR G-C9. OR G-C21.866.366 OR G2.403.776.573 OR G2.553 OR G2.403.776.605 OR G-E1.276 OR G-E1.210	223			1.5	.3
EAR DISEASES G-C9.218	42				
LARYNGEAL DISEASES G-C9.400	16				
NOSE DISEASES G-C9.603	14				
PHARYNGEAL DISEASES G-C9.775	19				
EYE DISEASES G-C11	107				
NUTRITIONAL AND METABOLIC DISEASES G-C18. OR G-E2.293	704			1.5	.3
DIGESTIVE SYSTEM DISEASES G-C6. OR G-C7. OR G-C23.888.821 OR G2.403.776.409.440	853			1.5	.3
BILIARY TRACT DISEASES G-C6.130	63				
GASTROINTESTINAL DISEASES G-C6.405	427				
LIVER DISEASES G-C6.552	159				

RADIOLOGIC TECHNOLOGY

TEXT	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCD HRS	UMCD PCT
MESH CODES					
CARDIOVASCULAR DISEASES G-C14. OR G-E1.145.569 OR G2.403.776.409.163 OR G-E1.399.214	924			1.5	.3
HEART DISEASES G-C14.280	398				
HYPERTENSION G-C14.907.489	162				
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY G-E1.145.569 OR G-E1.399.214	145				
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579			1.5	.3
UROLOGIC DISEASES G-C12	506			1.5	.3
KIDNEY DISEASES G-C12.777.419	357				
URINARY CALCULI G-C12.777.809	5				
URINARY TRACT INFECTIONS G-C12.777.892	46				
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166			1.5	.3
BACTERIAL INFECTIONS G-C1.252	472				
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11				
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215				
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86				

RADIOLOGIC TECHNOLOGY

TEXT	# OF QUES.	SHEPPARD HRS	SHEPPARD PCT	UMCD HRS	UMCD PCT
MESH CODES					
ENDOCRINE DISEASES G-C19. OR G-E1.197 OR G2.403.776.409.323	619			1.5	.3
ADRENAL GLAND DISEASES G-C19.53	97				
DIABETES MELLITUS G-C19.246	149				
PARATHYROID DISEASES G-C19.642	39				
PITUITARY DISEASES G-C19.700	37				
THYROID DISEASES G-C19.874	155				
NEOPLASMS G-C4	909			1.5	.3
DERMATOLOGIC DISEASES G2.403.776.185 OR G-C17. OR G-C23.888.885	299			1.5	.3
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565			1.5	.3
TOTAL HOURS IDENTIFIED		534.0		428.5	

RESPIRATORY THERAPY

TEXT	# OF	UMCU		BOISE	
	QUES.	HRS	PCT	HRS	PCT
MESH CODES					
ANATOMY & PHYSIOLOGY G-G1.100 OR G-G1.782 OR G-G7. OR G-G8. OR G-G9. OR G-G10. OR G-G11	2699	196.7	19.3	120.0	15.6
INTEGUMENTARY SYSTEM G-A1.835 AND (G-G1.100 OR G-G1.782) OR G-G10.795	22	2.0			
MUSCULOSKELETAL SYSTEM & BODY REGIONS G-G11.427 OR (G-A1. OR G-A2.) AND (G-G1.100 OR G-G1.782)	282	12.0			
DIGESTIVE SYSTEM G-G10.261 OR G-G10.549 OR (G-A3. OR G-A14.) AND (G-G1.100 OR G-G1.782)	413	4.0			
RESPIRATORY SYSTEM G-G9.772 OR G-A4. AND (G-G1.100 OR G-G1.782)	326	56.2		22.5	
CARDIOVASCULAR SYSTEM G-G9.188 OR G-G9.330 OR (G-A7. OR G-A15.) AND (G-G1.100 OR G-G1.782)	431	15.0		22.5	
ENDOCRINE & REPRODUCTIVE SYSTEMS (G-A5.360 OR G-A6. OR G-D6.472) AND (G-G1.100 OR G-G1.782) OR G1.782.323 OR G-G8.665 OR G-G8.520	575	8.0			
EXCRETORY SYSTEM G-G8.852 OR G-A5.810 AND (G-G1.100 OR G-G1.782)	93	3.5			
NERVOUS SYSTEM G1.782.562 OR G-G11.561 OR G-A8. AND (G-G1.100 OR G-G1.782)	403	21.0			
MICROANATOMY (G-A11. OR G-A10) AND (G-G1.100 OR G-G1.782)	250	10.0			
THE CELL G1.100.433 OR G-A11. AND (G-G1.100 OR G-G1.782)	130	3.0			
TISSUES G1.100.656 OR G-A10. AND (G-G1.100 OR G-G1.782)	179	4.0			
DEVELOPMENTAL ANATOMY - EMBRYOLOGY G-A16 AND G-G1.100 OR G1.100.529	75	2.0			
MICROBIOLOGY G-G1.273.540	536	60.0	5.8	45.0	5.8
BACTERIA G-B3 AND G-G1.273.540	301	28.0			
VIRUSES G-B4 AND G-G1.273.540	85	6.0			
RICKETTSIA G-B3.542.651 AND G-G1.273.540	9	2.0			
FUNGI G-B5.354 AND G-G1.273.540	20	6.0			
COMMON PARASITES G-B1 AND G-G1.273.540	13	6.0			
BACTERIOLOGICAL TECHNIQUES G-E5.909.123 OR G-D26.342	41				

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	BOISE HRS	BOISE PCT
MESH CODES					
PHARMACOLOGY G-G1.703 OR G-G2.628 OR G-G12.	1139	37.8	3.7	45.0	5.8
GENERAL PHARMACOLOGY G-G12.	128	6.0			
TOXICOLOGY G-C21.613.276 OR G1.703.795 OR G2.628.795	375				
DRUGS ACTING PRIMARILY ON THE CENTRAL NERVOUS SYSTEM (G-D15. OR G-D14) AND G-G1.703	221	7.8			
DRUGS ACTING PRIMARILY ON THE PERIPHERAL NERVOUS SYSTEM (G-D16. OR G-D17) AND G-G1.703	132	3.0			
DRUGS ACTING PRIMARILY ON THE CARDIOVASCULAR SYSTEM G-D18. AND G-G1.703	102	3.0			
HEMATOLOGIC AGENTS G-D19.461 AND G-G1.703	37				
RENAL AGENTS G-D19.770 AND G-G1.703	55	3.0			
GASTROINTESTINAL AGENTS G-D19.316 AND G-G1.703	21				
HORMONES AND DRUGS AFFECTING ENDOCRINE FUNCTION (G-D6. OR G-D7) AND G-G1.703	117	3.0			
ANTI-INFECTIVE AGENTS (G-D20. OR G-D21) AND G-G1.703	283	12.0			
ANTINEOPLASTIC AGENTS G-D22. AND G-G1.703	62				
IMMUNOLOGIC FACTORS G-D24.611 AND G-G1.703	6				
ENVIRONMENTAL POLLUTANTS, PESTICIDES G-D5. AND G-G1.703	10				

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	BOISE HRS	BOISE PCT
MESH CODES					
BIOCHEMISTRY G-G1.201 OR G-H1.181 OR G-G6	974	82.0	8.0	60.0	7.8
BIOSYNTHESIS AND/OR METABOLISM: G-G6.184 OR G-G6.535	570				
AMINO ACIDS G-D12.125 AND G-G1.201	58				
PEPTIDES G-G6.535.770 OR G-D12.644 AND G-G1.201	12				
PROTEINS G-D12.776 AND G-G1.201	76				
ENZYMES G-D8 AND G-G1.201	171				
NUCLEIC ACIDS G-G1.201 AND G-D13.444 OR G6.184.642 OR G6.184.661 OR G6.184.680	19				
LIPIDS G-G1.201 AND G-D10 OR G6.535.585	84				
CARBOHYDRATES G-G9 AND G-G1.201 OR G6.535.448 OR G6.535.411	62				
MINERALS - ELECTROLYTES G-D1.248 AND G-G1.201 OR G6.184.963 OR G7.621.888 OR G-G6.535.166.310 OR G-G6.184.29 OR G-G7.621.110	163	2.0			
NUTRITION G-G6.696 OR G2.513 OR (G-D11.786 AND G-G1.201)	101	5.0			
IMMUNOLOGY G-G4.610 OR G-D24.611 OR G-C20. OR G2.403.776.409.651 OR G-E1.223.826 OR G-E5.478 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	440	12.0	1.1		
BASIC IMMUNOLOGY G-G4.610 OR G-D24.611	222	6.0			
CLINICAL IMMUNOLOGY G2.403.776.409.651. OR G-C20. OR G-E1.223.826 OR G-E5.478. OR G-E2.95.520 OR G-E2.95.377 OR G-E2.95.449	348	6.0			
GENETICS G-G5 OR G-E5.393	133	3.5	.3		

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	BOISE HRS	BOISE PCT
MESH CODES					
BEHAVIORAL SCIENCES G-F1. OR G-F2. OR G-F3. OR G-F4.	296	84.0	8.2	45.0	5.8
BEHAVIOR AND BEHAVIOR MECHANISMS G-F1.	114	2.0			
PSYCHOLOGIC PROCESSES G-F2.	51	30.0			
BEHAVIORAL AND MENTAL DISORDERS G-F3.	193	.5			
PSYCHIATRIC TESTS & THERAPY G-F4	39	.5			
HEALTH CARE, ENVIRONMENTAL AND COMMUNITY HEALTH G-N1. OR G-N3. OR G-F1.829.401 OR G-N4. OR G-K1.316 OR G-H1.548.832 OR G-N2.421 OR G-N2.278	155	75.0	7.3	45.0	5.8
POPULATION CHARACTERISTICS G-N1.	103				
HEALTH SERVICES G-N2.421	8				
ECONOMICS G-N3.219	1				
SOCIAL CONTROL G-N3.706 OR G-I1.880.604	2	1.0			
HEALTH SERVICES ADMINISTRATION G-N4.	10	56.0		45.0	
PUBLIC HEALTH AND PREVENTIVE MEDICINE G-G2.403.776.756 OR G-G3.807.665 OR G-N2.421.143.827 OR G-N2.421.726	92	1.0			
ENVIRONMENT AND ENVIRONMENTAL HAZARDS G-G3.230 OR G-G3.372	39	2.0			
EMERGENCIES, INJURIES AND POISONING G-C21 OR G-E2.365	729	33.5	3.2		
POISONING G-C21.613	401				
WOUNDS AND INJURIES G-C21.866	271	1.0			
EMERGENCIES AND TREATMENT C23.280.420 OR G-E2.365	52	32.5			

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	BOISE HRS	BOISE PCT
MESH CODES					
LABORATORY MEDICINE - DIAGNOSIS, TECHNIQUES, METHODS G-E1.223 OR G-E5.196 OR G-E1.197 OR G-E5.909 OR G-E5.760	737	2.0	.1		
SPECIMEN HANDLING AND COLLECTION G-E1.223.894	65				
METHODS IN HEMATOLOGY G-E1.223.459	107	2.0			
BLOOD CHEMICAL ANALYSIS G-E1.223.174.229	115				
CYTODIAGNOSIS G-E1.223.230 OR G-E5.909.262	16				
PHYSICAL DIAGNOSIS G-E1.706 OR G-C23.888 OR E1.579	800	7.0	.6		
PHYSICAL EXAMINATION G-E1.706	225	6.0			
SIGNS AND SYMPTOMS G-C23.888	616	1.0			
MEDICAL HISTORY TAKING E1.579	6				
GYNECOLOGY AND OBSTETRICS G2.403.776.342 OR G2.403.776.542 OR G-E4.819 OR G-C4.588.945.315 OR G-C13	1043	4.4	.4		
GYNECOLOGIC DISEASES G-C13.371	285				
NORMAL PREGNANCY AND DELIVERY G-G8.520.769 OR G-E4.819.774.457 OR E2.472.786	287	4.4			
PREGNANCY COMPLICATIONS G-C13.703	262				
PEDIATRICS G2.403.776.671 OR G-C5.116.99 OR G-C16. OR G-G7.553 OR G-F1.227 ORG7.117.638.489 OR G-E2.95.377	1266	24.3	2.3		
GROWTH & DEVELOPMENT G-G7.553 OR G-F1.227	114				
THE NEWBORN INFANT G7.117.638.489	257	3.0			

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	BOISE HRS	BOISE PCT
MESH CODES					
SURGICAL PROCEDURES AND TECHNIQUES G-E4. OR G-G2.403.776.909	1044	40.3	3.9		
PRE AND POST OPERATIVE CARE G-E4.641 OR E4.624	13	3.0			
CARDIOVASCULAR SURGERY G-E4.752	20				
DIGESTIVE SYSTEM SURGERY G-E4.765	80				
ENDOCRINE SURGERY G-E4.779	22				
NEUROSURGERY G-E4.530	18				
OTORHINOLARYNGOLOGIC SURGERY G-E4.847	10				
THORACIC SURGERY G-E4.874	28				
UROGENITAL SURGERY G-E4.887	24				
ORTHOPEDICS AND PROSTHESES G-E4.557 OR G-E4.659 OR G2.403.776.909.494	58				
ANESTHESIA AND ANALGESIA G-E3. OR G2.403.776.59	53	15.0			
MINOR SURGERY E4.806	2				
RADIOLOGY G2.403.776.830 OR G-E1.818 OR G-E5.799 OR G-E2.810	242	2.0	.1		
RADIOGRAPHY G-E1.818	161	2.0			
RADIOTHERAPY G-E2.810	20				
ENDOCRINE DISEASES G-C19. OR G-E1.197 OR G2.403.776.409.323	619	3.0	.2		
ADRENAL GLAND DISEASES G-C19.53	47				
DIABETES MELLITUS G-C19.246	149				
PARATHYROID DISEASES G-C19.642	39				
PITUITARY DISEASES G-C19.700	37				
THYROID DISEASES G-C19.874	155				

TEXT	# OF QUES.	UMCU HRS	UMCU PCT	BOISE HRS	BOISE PCT
RESPIRATORY THERAPY					
MESH CODES					
INFECTIOUS AND PARASITIC DISEASES G-C1. OR G-C2. OR G-C3.	1166	9.0	.8		
BACTERIAL INFECTIONS G-C1.252	472				
COMMUNICABLE DISEASES - OUTBREAKS & RESERVOIRS G-C1.539.221	11	3.0			
MYCOSES G-C1.703	99				
RICKETTSIAL DISEASES G-C2.568	33				
VIRUS DISEASES G-C2.818	215				
PARASITIC DISEASES G-C3	91				
VENEREAL DISEASES G-C1.539.919 OR G-C1.252.847.840.744	86				
RESPIRATORY DISEASES G-C8. OR G-C23.888.852	974	308.5	30.3	405.0	52.
LUNG DISEASES G-C8.381	556	6.0			
PLEURAL DISEASES G-C8.528	84	1.0			
RESPIRATION DISORDERS G-C8.618 OR G-C23.888.852	227				
RESPIRATORY HYPERSENSITIVITY G-C8.674	53	2.0			
RESPIRATORY TRACT INFECTIONS G-C8.730	233	3.0			
RESPIRATORY THERAPY G-E2.365.647. OR G-E2.555. OR E6.497.578 OR E7.764	72	280.5		360.0	
NUTRITIONAL AND METABOLIC DISEASES G-C18. OR G-E2.293	704	5.0	.4		
DIGESTIVE SYSTEM DISEASES G-C6. OR G-C7. OR G-C23.888.821 OR G2.403.776.409.440	853	4.0	.3		
BILIARY TRACT DISEASES G-C6.130	63				
GASTROINTESTINAL DISEASES G-C6.405	427				
LIVER DISEASES G-C6.552	159				

RESPIRATORY THERAPY

TEXT	# OF QUES.	UMCO HRS	UMCO PCT	BOISE HRS	BOISE PCT
MESH CODES					
CARDIOVASCULAR DISEASES G-C14. OR G-E1.145.569 OR G2.403.776.409.163 OR G-E1.399.214	924	10.0	.9		
HEART DISEASES G-C14.280	398	4.0			
HYPERTENSION G-C14.907.489	162				
HEART FUNCTION TESTS, ELECTROCARDIOGRAPHY G-E1.145.569 OR G-E1,399.214	145	2.0			
HEMIC AND LYMPHATIC DISEASES G-C15. OR G2.403.776.409.543	579	4.0	.3		
UROLOGIC DISEASES G-C12	506	3.0	.2		
KIDNEY DISEASES G-C12.777.419	357				
URINARY CALCULI G-C12.777.809	5				
URINARY TRACT INFECTIONS G-C12.777.892	46				
NEOPLASMS G-C4	909	3.0	.2		
NEUROLOGIC DISEASES G-C10. OR G-E1.236 OR G2.403.776.505 OR G-C23.888.592 OR G-E1.399.277	565	3.0	.2		
TOTAL HOURS IDENTIFIED		1017.0		765.0	

Curricular matrix class hour data were obtained from the following institutions:

Boise State University
Boise, Idaho

Duke University
Durham, North Carolina

Georgia State University
Atlanta, Georgia

School of Health Care Sciences
Sheppard Air Force Base
Wichita Falls, Texas

University of Missouri-Columbia
Columbia, Missouri

Appendix D.1

GUIDELINES FOR WRITING QUESTIONS
FOR THE
PROFILE EXAMINATION AND/OR COMPUTER ITEM LIBRARY

1. Multiple choice questions using 5 alternate answers is the only acceptable format. Thus, no matching, true - false questions, or any other question form will be acceptable.

2. All questions should be prepared in the following manner:

   (1) An introductory statement explaining the subject matter. Followed by:
   (2) A question or statement which should ask the examinees for a response. Followed by:
   (3) Five distinct alternate answers that are related to the subject matter with only one choice designated as the correct response.
   (4) A reference source (Author, Book, Year, and Page Numbers or Journal, Volume, Page Numbers and Year)

   An Example:

   (1) When bleeding from the gastrointestinal tract (of a newborn) occurs in the first few hours after delivery, it is necessary to determine if the blood has originated from the mother or is coming from the neonate. (2) Vomitus, gastric aspirate, or stool containing red blood may be used for this purpose employing:

   (3) 1. The Motulsky test
       2. The Farber test
       3. The acidification denaturation test
       4. The Willoughby test
     * 5. The alkali denaturation test

   (4) Reference Source: Oski F. Hematologic Problems in the Newborn, 1972, p. 240

3. All questions should avoid any references to race, sex, profession, geographic location, etc. unless those factors are pertinent to the content of the question.

4. All questions should relate to subjects that are frequently utilized rather than highly technical material that is rarely used.

5. All questions should be consistent in the terminology and language used, i.e., do not mix specialized and technical words with popular and local terms.

6. In most instances a positive statement in the body of a question is preferred, however when appropriate, one can use this phrase: "All of the following are true except..."

7. Preferably there should be five distinct alternate answer choices related to the subject matter. However, IF NECESSARY, one can use any two number combinations, all of the above, or none of the above as a means of generating alternate choices.

8. Avoid giving clues by the grammatical construction of the question i.e., a singular verb used in the body of the question with three or four plural answer responses would help determine the incorrect answers.

9. All answer alternatives should be of equivalent length. This tends to disallow "correct guessing" as frequently the correct answer tends to be the longest.

10. Arrange the answers in some logical order from the lowest to the highest or vice versa when they involve numbers or a time span.

11. Double check to see that the body of the question and the five alternate answer responses coincide and form a complete sentence.

12. No need to capitalize or underline to emphasize a particular word in a question as the computer capitalizes all words when it prints the material and is unable to underline words at this time.

13. All questions should provide a reference which is from a standard text or easily available journal published within the past five years.

14. The computer at this time can only print a few symbols besides the standard punctuation marks used within the question body. They are: #, @, %, $, *, < , >, /, -, +, ( ), ¢, &, =, ¬, and |.

Appendix D.2

QUESTIONNAIRE GIVEN WITH INITIAL FIELD TESTING

NAME ______________________________________

Your answers to these questions will be very useful to us in evaluating the exam you have just completed. Your responses will be appreciated.

What did you think of the time allotted? (Check one)

Could work at a comfortable pace _____

Had to hurry in order to finish _____

Too little time allowed _____

What percentage of the questions were:

clear and precise ________%

ambiguous ________%

sum = 100 %

Regarding the difficulty of items, what percentage of the items:

could have been answered prior to the PA program _______%

can now answer as result of the PA program _______%

could answer by guessing _______%

were too difficult to answer correctly _______%

sum = 100 %

Regarding the relevancy of this exam to your PA curriculum, what percentage of the items were:

relevant _______%

not relevant ______%

sum = 100 %

Additional Comments:

Appendix D.3

RELIABILITY OF AUGUST AND NOVEMBER '74, FEBRUARY AND MAY, 1975

PROFILE EXAMINATION CATEGORIES AND TOTAL SCORE

	Reliability				Number of Items			
	Aug	Nov	Feb	May	Aug	Nov	Feb	May
Int Med	.955	.948	.890	.860	200	196	139	128
Peds	.862	.652	.774	.810	48	28	58	84
Ob/Gyn	.830	.566	.868	.775	60	28	63	57
Surgery	.868	.710	.676	.831	72	54	34	72
Basic Sci	.957	.913	.885	.896	200	150	147	130
Physiol	.884	.700	.596	.711	64	42	39	37
Biochem	.859	.840	.706	.697	58	32	31	26
Anatomy	.434	.478	.908	.354	114	14	19	14
Pharm	.942	.804	.791	.765	132	51	49	37
Micro	.858	.552	.345	.602	34	12	12	20
Infect Dis	.810	.679	.742	.641	33	18	30	20
Neoplasms	.761	.752	.691	.612	46	35	30	37
Musculoskel	.473	.351	-	.344	12	8	-	10
Digestive	.686	.387	.524	.630	30	19	16	29
Respiratory	.774	.750	.661	.381	21	29	22	13
Endocrine	.611	.724	.405	.478	17	23	13	15
CV	.547	.711	.494	.459	13	36	17	14
Hemic	.730	.696	.556	.593	17	23	15	18
Nerv Sys	.533	.654	-	.398	13	13	-	12
Nut & Met	.874	.645	-	.469	71	15	-	12
Inj,Poi,Im	.765	.570	.430	.543	24	30	11	22
Neonatal	-	.402	.532	.579	-	8	16	14
Gen Path	.724	.350	.622	.664	26	16	23	32
Techniques	.730	.776	.645	.670	52	38	28	28
Behav Sci	.505	.227	-	.316	8	14	-	17
Urogenital	.662	.508	-	-	34	12	-	-
Health Care	.208	-	-	-	11	-	-	-
Radiology	.471	-	-	-	12	-	-	-
Lib Sci	.303	-	-	-	5	-	-	-
TOTAL	.980	.954	.957	.957	400	400	400	400
Number of Examinees	295	356	352	306				

Appendix D.3

THE RELIABILITY OF THE
AUGUST AND NOVEMBER, 1975 AND FEBRUARY AND MAY 1976
PROFILE EXAMINATION CATEGORIES AND TOTAL SCORE

	Realiability				Number of Items			
	Aug	Nov	Feb	May	Aug	Nov	Feb	May
Int Med	.883	.866	.802	.831	109	86	69	80
Peds	.811	.850	.769	.790	80	81	63	72
Ob/Gyn	.820	.876	.794	.786	87	79	61	68
Surgery	.758	.839	.761	.735	69	83	61	69
Basic Sci	.871	.873	.907	.879	116	96	168	105
Physiol	.575	.393	.570	.661	17	14	34	24
Biochem	.558	.626	.646	.549	19	16	32	23
Anatomy	.525	.646	.765	.647	20	20	33	27
Pharm	.731	.653	.827	.836	33	21	35	33
Micro	.513	.634	.643	.611	17	21	36	24
Genetics	.459	-	-	-	10	-	-	-
Infect Dis.	.583	.658	.570	.644	19	31	21	26
Neoplasms	.645	.763	.664	.526	32	38	21	22
Musculoskel	-	.488	-	-	-	12	-	-
Digestive	.676	.585	.571	.614	27	24	24	30
Urogenital	.503	.410	-	.432	18	14	-	16
Respiratory	.487	.584	.457	.439	10	13	14	14
Endocrine	.571	.230	.306	.439	18	16	17	18
Cardiovascu	.595	.512	.569	.452	16	18	18	16
Hemic	.433	.618	.398	.398	15	21	13	12
Nerv Sys	.390	.535	.331	-	13	16	13	-
Skin Dis	-	-	-	.478	-	-	-	12
Nut & Meb	.496	.644	.489	.377	14	19	15	10
Inj,Poi,Im	.440	.665	.376	.259	20	24	22	23
Neonatal	.476	.526	-	.483	10	17	-	11
Gen Path	.605	.694	.672	.363	20	25	24	13
Techniques	.731	.719	.504	.605	32	32	32	35
Radiology	.199	.362	-	-	10	11	-	-
Behav Sci	.308	.119	-	-	12	11	-	-
Neurology	-	-	-	.236	-	-	-	10
TOTAL	.953	.964	.953	.955	400	400	400	400
Number of Examinees	324	395	385	337				

Appendix D.3

RELIABILITY OF THE AUGUST AND NOVEMBER 1976 AND FEBRUARY AND MAY 1977 PROFILE EXAMINATIONS

	Reliability				Number of Items			
	Aug	Nov	Feb	May	Aug	Nov	Feb	May
Int Med	.846	.865	.902	.871	77	81	80	78
Peds	.820	.773	.855	.842	72	54	57	62
Ob/Gyn	.787	.803	.878	.876	75	56	61	64
Surgery	.776	.782	.867	.833	70	57	55	59
Basic Sci	.890	.896	.911	.877	126	82	85	84
Physio	.639	.560	.595	.546	23	16	16	14
Biochem	.789	.699	.690	.635	28	16	19	16
Anatomy	.650	.600	.795	.723	23	15	18	18
Pharm	.712	.730	.672	.704	23	17	15	18
Micro	.436	.731	.673	.622	21	16	16	15
Genetics	-	-	-	-	-	-	-	-
Infect Dis	.513	.707	.629	.748	20	20	15	31
Neopl	.704	.786	.835	.751	30	30	33	27
Musculo	.342	.355	.358	.566	10	8	9	12
Digest	.492	.519	.785	.751	23	20	21	35
Urogen	.370	.472	.633	.548	11	10	16	13
Resp	.687	.694	.707	.645	23	18	20	16
Endo	.555	.572	.807	.613	13	13	19	17
CV	.526	.683	.678	.689	10	25	16	22
Hemic	.496	.435	.708	.686	12	8	14	11
Nerv Sys	-	-	-	-	-	-	-	-
Skin Dis	-	.750	-	-	-	3	-	-
Nut & Metb	.557	.610	.641	.689	11	14	13	18
Inj,Poi,Im	.557	.638	.812	.600	29	26	30	22
Neonatal	.491	.617	.700	-	19	12	19	-
Gen Path	.521	.729	.737	.581	19	19	21	10
Tech	.654	.676	.647	.630	29	35	23	21
Radiology	-	-	-	-	-	-	-	-
Behav Sci	-	.325	.291	.290	-	7	9	10
Neurology	-	.686	.459	.613	-	18	12	14
TOTAL	.954	.951	.974	.968	400	400	338	347
Number of Examinees	396	464	416	352				

Appendix D.4

INTERCORRELATIONS OF SCIENCE GRADES

Courses	Genl Chem	Chem II	Orgnc Chem	Biology	Physiology	Microbio	Genetics	Botany	Zoology
Genl Chem	r p N	.43 .01 92	.37 .01 82	.29 .01 84	.29 .02 59	.23 .20 32	.49 .03 19	.32 .17 19	.62 .01 38
Chem II	---	---	.56 .01 84	.31 .01 85	.25 .01 60	.25 .15 33	.24 .66 19	.61 .01 20	.43 .01 38
Organic Chem	---	---	---	.60 .01 80	.50 .01 60	.13 .50 29	.78 .01 18	.68 .01 20	.53 .01 36
Biology	---	---	---	---	.42 .01 59	.28 .11 33	.46 .03 21	.60 .01 22	.29 .07 39
Physiology	---	---	---	---	---	-.18 .52 18	.58 .06 11	.78 .01 11	.74 .01 22
Microbiology	---	---	---	---	---	---	.18 .67 8	.65 .05 9	.48 .05 17
Genetics	---	---	---	---	---	---	---	.17 .63 10	.23 .60 16
Botany	---	---	---	---	---	---	---	---	.77 .01 14
Zoology	---	---	---	---	---	---	---	---	---